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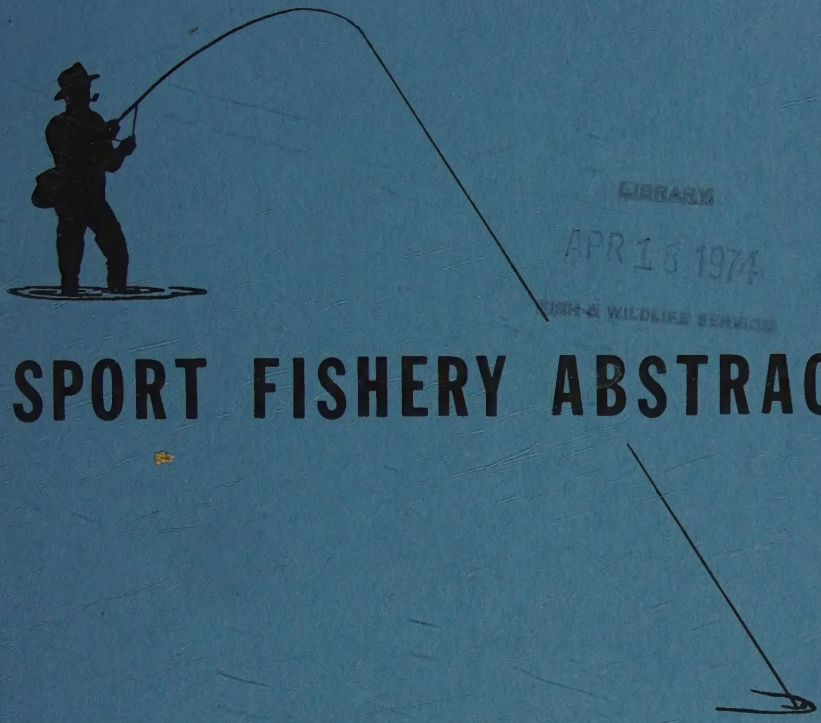

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SPORT FISHERY ABSTRACTS

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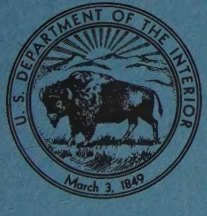

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BUREAU OF SPORT FISHERIES AND WILDLIFE

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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16685. Powell, T. G. 1973. EFFECT OF NORTHERN PIKE INTRODUCTIONS ON AN OVERABUNDANT CRAPPIE POPULATION. Special Report No. 31, Colorado Div. of Wildl., State Publication Code W-R-S 31, price $1.00, 6 p.

A cyclic pattern of abundance was found in the white crappie population of Carbody Reservoir, Colorado, in 1965. Establishment of a viable northern pike population in this water was not accomplished until large numbers of subadults (8-10 inches) and fingerlings (2 inches) were planted in 1969. Ensuing northern pike predation resulted in an increased average size in age group III crappie and a leveling of the abundance cycle. At the conclusion of the study, however, the cycle still appeared to be in existence. Stocking recommendations are given for the sizes of fish used, along with a recommendation for the size of northern pike effective in panfish population reduction. Other predation studies with this species are under way. (Auth.)

16686. Hickey, Clarence R. (N. Y. Ocean Sci. Lab., Montauk, New York 11954). 1973. COMMON ABNORMALITIES IN FISHES, THEIR CAUSES AND EFFECTS. Trans. Northeast Fish & Wildl. Conf., May 14-17, Ellenville, N.Y., pp. 71-83.

Many types of naturally occurring abnormalities have been reported to occur in fishes. Some of the more common types are discussed here - spinal and vertebral, pugheadness and anomalies of the fins. Although the actual causative agents are unknown, genetic and embryonic causes are suspected. An increasing amount of literature suggests that changing environmental conditions and environmental pollution may play a role. These agents affect the weakest stage (embryonic or larval) in a fish's life history. The frequency of discovered abnormalities may prove to be an index of pollution. Much further research is needed. (Auth.)

16687. Hart, John L. (St. Andrews, New Brunswick, Canada). 1973. PACIFIC FISHES OF CANADA. Fisheries Research Bd. of Canada Bulletin 180, 740 p., illus., price $8.00.

This book is intended to meet the needs of both laymen and students. It succeeds and partly replaces "Fishes of the Pacific Coast of Canada" (Clemens and Wilby) with more than 50 additional species and up-to-date nomenclature. Analytical keys allow the identification of all recorded kinds of fishes. Species accounts contain new illustrations, and expanded information on life history, distribution, and role in the economy. A gazetteer and new glossary are included as well as specially prepared colour photographs of all Pacific salmons and selected other species.

16688. Recksiek, Conrad W., and James D. McCleave (Dept. of Zool., Univ. of Maine, Orono, Maine 04473). 1973. DISTRIBUTION OF PELAGIC FISHES IN THE SHEEPSCOT RIVER - BACK RIVER ESTUARY, WISCASSET, MAINE. Trans. Amer. Fish. Soc., 102(3): 541-551.

Fifteen species of pelagic fishes were collected in 156 gill net sets at eight locations in the Sheepscot River - Back River estuary, Wiscasset, Maine, June 1970 through December 1971. Highest catches occurred June through August. Only the rainbow smelt is a year-round resident. Differences in abundance in space and time are apparently related to temperature. During the summer, alewives, blueback herring, and Atlantic menhaden were most abundant in the relatively warm Back River estuary, while Atlantic herring, Atlantic mackerel, and spiny dogfish were most abundant in the more oceanic Sheepscot River estuary. Prolonged near-freezing temperatures apparently limit the time pelagic fishes spend in the estuary and limit the number of species which can inhabit it. It is hypothesized that the distribution of pelagic species which exhibited preferences for colder water, such as Atlantic herring, would be most affected by artificial warming of the surface waters of the Back River estuary, if a new atomic powered generating plant were allowed to discharge heated effluent directly into it. (Authors)

16689. Engett, Mary Ellen, and Lee C. Thorson. 1973. FISHERY PUBLICATIONS, CALENDAR YEAR 1966: LISTS AND INDEXES. NOAA Technical Report NMFS CIRC-382, 19 p.

16690. Holeton, G. F. (Dept. of Zool., Univ. of Toronto, Toronto, Ontario). 1973. RESPIRATION OF ARCTIC CHAR (Salvelinus alpinus) FROM A HIGH ARCTIC LAKE. J. Fish. Res. Bd. Canada, 30(6): 717-723.

The routine of resting oxygen consumption of Arctic char (Salvelinus alpinus) from a high arctic lake (74°42'N) was measured at 2 (acclimated) and 6 C (unacclimated). The oxygen uptake versus wet weight relation at 2 C was: Log O_2 uptake = 0.7316 Log weight - 1.0944. Oxygen uptake was low, not showing any evidence of "cold adaptation," and was comparable to projections of oxygen uptake versus temperature relations of other salmonid fish from lower latitudes. The short term metabolic response to a rise in temperature of 4 C was independent of body size except with fish with yolk sacs and weighing less than 0.125 g. (Auth.)

16691. Schneider, James C. 1973. THE STANDING CROP OF FISH IN MICHIGAN LAKES. Mich. Dept. of Nat. Resources, Fish. Div., Fish. Res. Report No. 1794, 35 p.

Estimates of the standing crops of fish in 64 lakes and ponds in Michigan were summarized. The estimates were adjusted, when necessary, to include fish which were not estimated originally. Lakes with slow-growing bluegills had the highest total standing crops of fish, 182 pounds per acre. Lakes with only slow-growing yellow perch had the smallest fish crops, 46 pounds per acre. Lakes with fish populations of normal species diversity and growth averaged 88 pounds per acre. Other lakes, with poor or unusual fish populations, contained 104 pounds per acre. Multiple regression-correlation analyses were performed. Lake alkalinity, area, depth, alkalinity divided by depth (index), and the logarithm of each of these variables--these factors accounted for only 25% of the variation in the logarithm of fish standing crop when data from all lakes were pooled. Stratifying the data according to type of fish, and to trout lake versus warmwater lake, resulted in significant regressions. However, application of these results is limited because: (1) sample size was small in certain strata, (2) performance of particular variables in different regressions was inconsistent, and (3) the range in variables was relatively narrow. (Auth.)

16692. Serchuk, Fredric M., and David W. Frame (Mass. Coop. Fish. Unit, Univ. of Mass., Amherst, Massachusetts 01002). 1973. AN ANNOTATED BIBLIOGRAPHY OF THE CUNNER Tautogolabrus adspersus (Walbaum). NOAA Technical Report NMFS SSRF-668, 43 p.

This annotated, indexed bibliography of the cunner contains 347 entries including references on taxonomy, distribution, life history, physiology, behavior, commercial and sport fisheries, and related fields. It may be considered current through June 1972. (Authors)

16693. Schäperclaus, W. 1972. ORAL AND PARENTERAL IMMUNIZATION OF CARP AGAINST Aeromonas punctata. (Orale und parenterale aktive Immunisierung von Karpfen gegen Aeromonas punctata). Archiv für Experimentelle Veterinärmedizin, Vol. 26, No. 5: 863-874.

The author compares the role of intestinal coliforms of humans and other mammals with that of Aeromonas punctata (A. hydrophila and A. liquefaciens, synonyms) in carp. In both cases normal adults contain specific antibodies due to normal association with these bacteria. The author immunized carp with whole cells and soluble antigen (toxoid with formalin) parenterally and orally. Parenteral immunization resulted in better protection and higher antibody titre. Orally immunized fish contained less circulating antibody than those immunized parenterally. The soluble antigen produced better immunity than cells. Also the soluble antigen produced a more broad protection against more serotypes of A. punctata. Fish immunized orally with whole cells had about the same titre of antibodies as fish immune due to the normal exposure. In practice oral immunization with soluble antigen increased the level of immunity and increased survival but is much less effective than treatment with antibiotics. In some lots of experimental carp a myxobacterial gill disease developed. This seems to be the first record of bacterial gill disease in cultured carp. -- S. F. Snieszko

16694. Mount, Donald I. (Environ. Protection Agency, Nat'l Water Qual. Lab., Newtown Fish Toxicology Lab., 3411 Church St., Cincinnati, Ohio 45244). 1973. CHRONIC EFFECT OF LOW pH ON FATHEAD MINNOW SURVIVAL, GROWTH AND REPRODUCTION. Water Research, 7(7): 987-993.

Fathead minnows (Pimephales promelas Rafinesque) were continuously exposed to reduced pH levels of 4.5, 5.2, 5.9, 6.6 and 7.5 (control) during a 13-month, one-generation test. Survival was not affected, even at the lowest pH tested. Fish behavior was abnormal, and fish were deformed at pH 4.5 and 5.2. Egg production and egg hatchability were reduced at pH 5.9 and lower, and all eggs were abnormal. A pH of 6.6 was marginal for vital life functions, but safe for continuous exposure. Free carbon dioxide, liberated by the addition of sulfuric acid to reduce the pH, may have had an unknown effect. The fish did not become acclimated to low pH levels. (Auth.)

16695. Makogon, Kh. G. 1972. ROLE OF SPHAERIID MOLLUSKS IN DISTRIBUTION OF THE CAUSATIVE AGENT OF CREPIDOSTOMATOSIS OF FISH. Hydrobiological Journal, 8(2): 63-65.

The composition of the malacofauna of Sphaeriidae in warmwater (carp) fisheries differs radically from that in cold-water (trout) fisheries. There are almost no sphaeriids in the former, whereas they are the dominant mollusk group in the latter. Among the sphaeriid species examined, P. casertanum was found (for the first time in the Ukraine) to be functioning as an intermediate host of the trematode C. farionis, the causative agent of crepidostomatosis of salmon and graylings. The extent of infestation of mollusks with C. farionis larvae ranges from 5 to 42 percent.

16696. Il'ina, L. K., and N. A. Gordeyev (Inst. of the Biol. of Inland Waters, USSR Acad. of Sciences, Borok, Yaroslavl Province, USSR). 1972. WATER-LEVEL REGIME AND THE SPAWNING OF FISH STOCKS IN RESERVOIRS. J. Ichthyol., 12(3): 373-381.

The possibility of reconciling the interests of the fishing industry and of other water users is considered on the basis of an analysis of the spawning conditions of phytophilous fish in the existing lowland reservoirs. Recommendations are made concerning the regulation of water-level regime in reservoirs of different types in relation to their position in the chain of reservoirs and to the stage of formation.

16697. Allen, Kenneth O. 1972. MYXOBACTERIA INFECTIONS OF STRIPED BASS. Newsl. SE Coop. Fish Dis. Proj. 9: 3.

Infections of fishes from a circular raceway culture experiment at Fish Farming Experiment Station, Stuttgart, Arkansas is discussed. Three unsuccessful treatments are discussed and an effective temperature control is presented.

16698. Lovell, R. T. (Dept. of Fish. & Allied Aquacultures, Auburn Univ., Auburn, Alabama 36830). 1972. PROTEIN REQUIREMENTS OF CAGE-CULTURED CHANNEL CATFISH. Presented at 26th Ann. Conf., SE Assn. of Game and Fish Commissioners, Oct. 22-25, 1972, Knoxville, Tenn., 7 p.

Twenty suspended 1-m^3 cages were each stocked with 300 five-to six-inch channel catfish fingerlings to allow for the evaluation of five feeding regimens, each replicated four times. The experiment began April 15 and terminated October 21, providing for a 180-day feeding period. The daily feeding rate was 4% of biomass initially and decreased to 1.5% of biomass during the latter phase of the feeding trial. The experimental feeds were nutritionally complete, low-fiber, expanded (nonsinking) 3/16-inch diameter pellets. Treatments (diets) 1 through 3 contained protein levels of 40, 35, and 30%, with 38% of the protein in each diet coming from fishmeal and the remainder from plant sources. Diet 4 was designed to contain the same theoretical amino acid composition as diet 1 with only 17.5% of the protein coming from fishmeal and the deficient amino acids supplemented in isolated form. The fifth feeding regimen was feeding the 40% protein diet until the fish reached 0.5 lb then feeding the 30% protein diet for the remainder of the period. Mean responses to treatments 1 through 5, respectively, were as follows: weight gain per fish (lb), 1.31, 1.28, 1.24, 0.97 and 1.25; feed conversion ratio, 1.26,

1.26, 1.29, 1.36 and 1.31. Based upon diet ingredient costs treatment 3 effected the least cost per pound of gain, followed by treatments 2, 5, 4, and 1, respectively. (Auth.)

16699. Wolf, Ken, and M. C. Quimby (Eastern Fish Dis. Lab., Leetown, Box 17A, Kearneysville, West Virginia 25430). 1973. FISH VIROLOGY: PROCEDURES AND PREPARATION OF MATERIALS FOR PLAQUING FISH VIRUSES IN NORMAL ATMOSPHERE. U. S. Dept. of Interior, Bur. of Sport Fish. & Wildl., Fish Disease Leaflet-35, 13 p.

This is intended to be a laboratory handbook for a unified procedure of plaquing all fish viruses.

16700. Schneider, James C. 1973. DENSITY DEPENDENT GROWTH AND MORTALITY OF YELLOW PERCH IN PONDS. Mich. Dept. of Natural Res., Fish. Div., Fish. Res. Report No. 1795, 18 p.

Survival and growth of perch during their first 6 months of life were studied in relation to the density of older perch in replicated ponds at the Saline Fisheries Research Station from 1969 to 1972. Data on the growth and survival of older perch, and on the effects of pond types, were obtained also. In the spring of the year, the ponds were stocked with fertilized perch eggs and either no, low, or high numbers of fingerling (mostly yearling) perch. Stocking rates were selected so as to simulate densities, and produce growth rates, found in natural populations. In the fall of the year, the ponds were drained and the fish counted. I found that the number of young perch which survived was higher in the ponds rich in plankton than in the ponds with extensive stands of cattails, at all levels of fingerling density. In the cattail ponds, survival of young was reduced only at high fingerling densities, whereas in the plankton-rich ponds, even low numbers of fingerlings appeared to reduce survival of young. Growth of young compensated for abundance of young, with the result that cattail ponds produced 84 pounds of young per acre and the plankton ponds produced 108 pounds per acre, regardless of fingerling abundance. Growth of young was linearly related on a log-log scale to their own density. Competition with fingerlings did not affect growth of young until they reached a length of about 4.4 inches--a size not usually attained in natural populations in one year. Between 10.9 and 52.9% of the planted fingerlings died of natural causes during each experiment. Survival was not related to density or pond type. Growth of individual fingerlings was inversely related to density; however, the ponds stocked at the highest rates produced the largest total standing crops. (Auth.)

16701. Bond, W. A. (Dept. of the Environ., Fish. and Marine Service, Winnipeg, Manitoba, Canada). 1973. AN INVESTIGATION OF THE COMMERCIAL FISHERY AT LAC LA MARTRE, N.W.T., 1972. Resource Mgmt. Branch, Central Region, Technical Report Series No. CENT-73-5, 50 p.

Lac la Martre has been fished commercially each summer since 1969 and has produced an annual average of 208,639 pounds of whitefish and 42,648 pounds of lake trout. In 1969 and 1970, 5-1/2 inch gill nets were used exclusively by the commercial fishermen but in 1972 more than 80% of the nets in use were 6-1/4 inch. Test netting indicated little change in the species composition of Lac la Martre since 1969 with whitefish, trout and longnose suckers making up 58.9, 16.9 and 20.8% of the catch, respectively. The structure of the whitefish population was also similar to that found in 1969 with 72% of the sample being longer than 450 mm. Only 3% of the whitefish and 2% of the trout were taken in 6-1/4 inch gill nets. The catch per unit of effort in 6-1/4 inch commercial nets was 47.0 pounds of whitefish and 8.7 pounds of trout per 100 yards per 24 hours. 80.4% of the commercial whitefish catch and 82.4% of the trout catch was taken from 27.2% of the water area. Cullage was 70,000 pounds, about 2/3 of which was whitefish. People and dogs at Lac la Martre are estimated to consume about 200,000 pounds of whitefish and trout per annum. The total annual harvest from the lake approximates 500,000 pounds, twice the present quota. (Auth.)

16702. Spivey, W. Allen (The Univ. of Mich., Ann Arbor, Michigan 48104). 1973. OPTIMIZATION IN COMPLEX MANAGEMENT SYSTEMS. Trans. Amer. Fish. Soc., 102(2): 492-499.

16703. Ishihara, Tadashi, Hisashi Kinari, and Masato Yasuda (Faculty of Fish., Nagasaki Univ., Nagasaki, Japan). 1973. STUDIES ON THIAMINASE I IN MARINE FISH - II. DISTRIBUTION OF THIAMINASE IN MARINE FISH. Bull. Jap. Soc. Sci. Fish., 39(1): 55-59, in Japanese with English abstract.

Fifty species of marine fish were investigated for the distribution of thiaminase I, and high thiaminase activity was detected in the following 11 species, namely, Konosirus punctatus, Engraulis japonica, Cololabis saira, Hemiramphus sajori, Fistularia petimba, Sardinops melanosticta, Harengula zunasi, Prognichthys agoo, Spratelloides japonicus, Tylosurus melanotus, and Mugil cephalus. In the first five of these species thiaminase activity was found in the muscle as well as in the viscera. The other species did not show such activity in the muscle. Generally, thiaminase activity was higher in the viscera than in the muscle. It was particularly high in the spleen of Mugil cephalus, in the kidney of Cololabis saira and Konosirus punctatus, and in the intestine of Hemiramphus sajori. With seven out of the above 11 species, the optimum pH value for thiaminase ranged from 4.0 to 6.5. However, with some species, it varied by organ even within the same individual fish: the optimum pH value for thiaminase with Mugil cephalus was 5.5 in the spleen but 6.5 in the liver and pyloric caecum. With Tylosurus melanotus, it was 4.0 in the spleen but 5.5 in the liver.

16704. Warren, E. W. (Dept. of Life Sciences, The Polytechnic of Central London, 115 New Cavendish St., London W1M 8JS, England). 1973. THE ESTABLISHMENT OF A 'NORMAL' POPULATION AND ITS BEHAVIOURAL MAINTENANCE IN THE GUPPY - Poecilia reticulata (Peters). J. Fish Biol., 5(3): 285-304.

Populations of the guppy - Poecilia reticulata (Peters) - were established with a single male and female fish per compartment. In spite of excess food, regular water changes, constant temperature and continuous aeration, the populations eventually reached a stable asymptote which was proportional to the size of the compartment, particularly when the populations were visually isolated from other populations. A weight asymptote was achieved some time after the population plateau. There was a tendency for females to exceed the numbers of males at the asymptote. Fish from the asymptotes were rearranged to relatively increase or decrease the populations, on the expectation that the populations would revert to the original asymptote. This did not happen. It was hypothesized that there was a learned behavioural response which prevented reproduction in the altered populations, but an ovarian 'carry-over' for the ovaries of decreased and increased populations were distinguishable. The learning hypothesis was substantiated in fish of a single generation which were crowded, then uncrowded, and continued to show reduced courtship and increased aggressive behaviour. (Auth.)

16705. Olson, Wayne H., Dean L. Chase, and James N. Hanson (Bur. of Sport Fish. and Wildl., Alchesay National Fish Hatchery, Whiteriver, Arizona 85941). 1973. PRELIMINARY STUDIES USING SYNTHETIC POLYMERS TO REDUCE TURBIDITY IN A HATCHERY WATER SUPPLY. Prog. Fish-Cult., 35(2): 66-73.

Water supplying the Alchesay National Fish Hatchery in Arizona is extremely turbid during certain periods of the year. This paper reports on preliminary testing of anionic and cationic synthetic polymers for clarifying water during actual storm conditions. Instruments recorded turbidity levels of water diverted from the main hatchery supply and furnished to three test groups of rainbow trout (Salmo gairdneri); one untreated and two treated flows were monitored. Polymer was automatically metered into the water when turbidity reached 70 Jackson Turbidity Units (J. T. U.) or higher; the level at which fish stopped feeding. Over 1,000 hours of turbidity occurred during 1971 where treatment of water was necessary. It was shown that heavy silt loads could be removed and normal fish cultural activities maintained without interruption. Turbidities approaching 7,000 J. T. U. were reduced below 35 with no adverse effects on fish. (Authors)

16706. Lewis, Steven A. 1972. BIBLIOGRAPHY OF LITERATURE ON OKLAHOMA WATERS. Oklahoma Fishery Research Lab. Bull. No. 10, 151 p.

16707. Kulikova, N. I. (Amur Dept., Pacific Res. Inst. for Sea Fisheries and Oceanogr., (TINRO), Khabarovsk, USSR). 1972. VARIABILITY AND SPECIATION IN THE CHUM SALMON [Oncorhynchus keta (Walb.)]. J. Ichthyol., 12(2): 185-197.

Consideration is given to the direction and nature of the variability of morphological and biological characters of the summer and autumn chum [Oncorhynchus keta (Walb.)] spawning in different rivers of the Soviet Far East. Investigations have shown that this species possesses marked ecological and geographical variability of characters. On the basis of data obtained on species variability an attempt is made to trace the origins of the summer and autumn races of the chum.

16708. Malyarevskaya, A. Ya., T. I. Birger, O. M. Arsan, and V. D. Solomatina 1972. METABOLIC RELATIONSHIPS BETWEEN BLUE-GREEN ALGAE AND FISH. Hydrobiological Journal, 8(3): 35-41.

The effect of the metabolic products and decomposition of blue-green algae, mainly Microcystis aeruginosa Kütz. emend. Elenk, on some indicators of biochemical composition and metabolism of fish was studied.

16709. Aoki, Takashi, and Tsutomu Watanabe (Lab. of Aquaculture Biol., Dept. of Fish., Faculty of Agric., Univ. of Tokyo, Tokyo, Japan). 1973. STUDIES OF DRUG-RESISTANT BACTERIA ISOLATED FROM EEL-POND WATER AND INTESTINAL TRACTS OF THE EEL (Anguilla japonica AND Anguilla anguilla). Bull. Jap. Soc. of Sci. Fish., 39(2): 121-130. In Japanese with English abstract.

A rather wide variety of drug resistant gram-negative bacteria were isolated from the eel-pond water as well as from the intestinal tracts of cultured and wild eels (Anguilla japonica and Anguilla anguilla) in various districts. A fairly high proportion of the drug resistant bacteria isolated were found to carry R factors. Occurrence rate of R factor-carrying bacteria varied in different districts, being high in the Yaizu and Yoshida areas and low in the Hamana-Lake area and in wild eels. R factors were found in Aeromonas liquefaciens, Vibrio and Enterobacteriaceae strains but not in Achromobacter, Alcaligenes, Pseudomonas strains. The drug-resistance markers of the R factors were almost exclusively sulfonamides and tetracycline. This tendency was apparent particularly in A. liquefaciens.

16710. Schneider, James C., and Thomas M. Kelly. 1973. ADDITIONAL OBSERVATIONS ON GROWTH RATE AND FOOD HABITS OF THE WALLEYE IN MICHIGAN WATERS. Mich. Dept. of Nat. Res., Fisheries Research Report No. 1796, 10 p.

We examined the ages and stomach contents of adult and sub-adult walleyes collected from Houghton Lake, Lake Cadillac, Lake Gogebic, and Lake Whittlesey in 1971, and from Lake Gogebic and three lakes on Isle Royale in 1928. Walleye growth appears to be slower than the state average in these lakes; also, the growth of walleyes in Lake Gogebic, Houghton Lake, and Lake Cadillac may have declined in recent years. Fish, especially yellow perch, were the principal food of the walleye, being found in 67-100% of the stomachs containing food. No correlation was found between size of the walleye and size of prey fish found in its stomach. (Authors)

16711. Nelson, Joseph S., and Martin J. Paetz (Dept. of Zool., The Univ. of Alberta, Edmonton, Alberta, Canada). 1972. FISHES OF THE NORTHEASTERN WOOD BUFFALO NATIONAL PARK REGION, ALBERTA AND NORTHWEST TERRITORIES. Canad. Fld Nat., 86, pp. 133-144.

Five species of small fishes (northern redbelly dace, fathead minnow, pearl dace, brook stickleback, and Iowa darter) have their known northern distributional limits in landlocked lakes and small creeks in the northern Wood Buffalo National Park region. They are surprisingly abundant along their northern fringe but are poorly known to the immediate south. The majority of individuals of two species of stickleback (brook and ninespine sticklebacks) fail to develop the pelvic skeleton in several localities. Habitats within the region are unusual, consisting of karst topography (with sinkhole lakes and the possibility of underground drainage connections) and streams of relatively high salinity. (Authors)

16712. Falk, M. R., and M. J. Lawrence. 1973. ACUTE TOXICITY OF PETROCHEMICAL DRILLING FLUIDS COMPONENTS AND WASTES TO FISH. Dept. of the Environ., Resource Mgmt Branch, Central Region, Technical Report Series No. CEN T-73-1, 108 p.

During 1972, a study was carried out on the nature and acute toxicity of petrochemical drilling fluids, constituent chemicals and wastes. A field program, conducted in the Mackenzie delta area, N.W.T., was designed to acquire information on the nature and amounts of drilling fluid compounds used, the efficiency of waste containment facilities and on the toxicities of drilling and sumps fluids. A laboratory program determined acute toxicities of drilling fluids and their constituent chemicals through a contract issued to Dr. J. Sprague, University of Guelph. Drilling fluids were acutely toxic with 96 hour LC50's of 0.83 to 12.0 percent using lake chub and rainbow trout. Sump fluids were comparatively less toxic with one sump yielding 96 hour LC50's of 22.5 and 81.0 percent for composite and surface sump fluids, respectively. Out of 27 common components of drilling fluids, seven were toxic and six were moderately toxic. Recommendations on waste containment, treatment and future studies are given. A brief description of the nature and function of drilling fluids and their constituent chemicals is also included. (Authors)

16713. Bootsma, R. (Dept. of Special Animal Pathol., Vet. Faculty, Biltstraat 172, Univ. of Utrecht, Netherlands). 1973. AN OUTBREAK OF CARP (Cyprinus carpio L) ERYTHRODERMATITIS CAUSED BY A MYXOBACTERIUM. Aquaculture No. 2, pp. 317-320.

An outbreak of carp erythrodermatitis (CE) appeared to be caused by a myxobacterium. The significance of this finding is discussed in view of the unknown aetiology of CE. (Auth.)

16714. Larson, Gary Lee (Fish. Res. Inst., Coll. of Fish., Univ. of Washington, Seattle, Washington). 1973. A LIMNOLOGY STUDY OF A HIGH MOUNTAIN LAKE IN MOUNT RAINIER NATIONAL PARK, WASHINGTON STATE; USA. Archiv für Hydrobiologie, 72(1): 10-48.

Mowich Lake, at an elevation of 1502 m in Mount Rainier National Park, was studied from March to November, 1967. The lake was low in mineral content and unproductive. The winter lake cover developed into a floating snow pack up to 3.75 m in thickness. The lake cover appeared to play an important role in primary production by way of nutrient additions. Primary production, extractable phytoplankton pigments and total phytoplankton biomass were strongly correlated in both time and space, and were maximal in July. The maximum primary production was 152/m^2 and 21/m^3 mg C assimilated per day. Maximum phytoplankton biomass was 32/m^2 and 1.7/m^3 gm fresh weight. The activity quotient [(mg C assimilated/m^2/day)/(mg phytoplankton biomass/m^2] indicated the primary production of Mowich Lake to be in the oligotrophic range. The zooplankton community consisted of eight species of Rotifera. The only crustacean, Eucyclops agilis, was occasionally taken pelagically, but was usually confined to littoral and benthic regions. Zooplankton populations were maximal between early October and mid-November. The egg ratio reproductive rate, B (eggs/female/day), was maximal from September to early October. Other population coefficients were also calculated for Kellicottia longispina (b', r', and d') and Keretella hiemalis (b' and r'). The macro-benthos was about intermediate in mean dry weight (1.8 gm/m^2) as compared to other oligotrophic lakes and was dominated by Chironomidae. (Auth.)

16715. Hynes, H. B. N. 1970. THE ECOLOGY OF RUNNING WATERS. Univ. of Toronto Press, Toronto, xxiv + 555 pp. $25.00. Reviewed by Joseph S. Nelson, Reprint from Canad. Fld Nat., 86(1), 1972.

This is a comprehensive book on stream ecology. The bibliography is an excellent comprehensive review of the literature up to and including 1966, and contains over 1,500 listings.

16716. Bachmann, P. A., and W. Ahne (Inst. of Microbiol. and Infectious Diseases of Animals, Univ. of München, Veterinärstr. 13, 8000 München 22, Germany). 1973. ISOLATION AND CHARACTERIZATION OF AGENT CAUSING SWIM BLADDER INFLAMMATION IN CARP. Nature, 244(5413): 235-237.

A rhabdovirus is described as the agent causing swimbladder inflammation in carp. Future investigations are necessary to determine whether this virus is identical or related to another carp rhabdovirus, which has been identified as the causative agent of the acute form of infectious dropsy.

16717. Leopold, Marian (Affiliation: Instytut Rybactwa Srodladowego w Olsztynie, Zaklad Ekonomiki Rybactwa). 1972. METHODOLOGY OF FORECASTING AND EVALUATING CATCHES OF FISHES WITH SHORT LIFETIME IN THE POLISH LAKES (ON THE EXAMPLE OF Coregonus albula (Linnaeus). [Metodyka prognozy i oceny polowow ryb o krotkim cyklu zyciowym w jeziorach Polskich (na przykladzie sielawy - Coregonus albula (Linnaeus)]. Roczniki Nauk Rolniczych, Series H, 94(4): 98 p. In Polish with English summ. and synopsis).

The results of studies of Coregonus albula (L.) catches in the Polish lakes by the methods of multiple correlation and regression have shown the possibility of utilizing the revealed relationships for the forecasting of these catches and for evaluating the management of populations of fishes. A simple and communicative method was elaborated and presented, open to modifications and having much practical application under various conditions. (Auth. synopsis).

16718. Yoshinaka, Reiji, Mamoru Sato, and Shizunori Ikeda (Dept. Fish., Fac. Agr., Kyoto Univ., Kyoto, Japan). 1973. STUDIES ON COLLAGENASE OF FISH - I. EXISTENCE OF COLLAGENOLYTIC ENZYME IN PYLORIC CAECA OF Seriola quinqueradiata. Bull. Jap. Soc. Sci. Fish., 39(3): 275-281. In English.

A collagenolytic activity capable of degrading native collagen under non-denaturing conditions was detected in the pyloric caeca of yellow-tail, Seriola quinqueradiata. The pyloric caecum enzyme was capable of reducing the specific viscosity of carp skin collagen at pH 7.5 and 20°C. Crude enzyme extracts from the pyloric caeca, which is a digestive organ, exhibited significant neutral protease activity. The effects of α-chymotrypsin and trypsin on the viscosity of collagen were rather small. However, the pyloric caecum enzyme produced marked viscosity reduction in collagen preparations. This indicates that a collagenolytic enzyme, distinct from α-chymotrypsin and trypsin, may exist in the pyloric caecum extracts. The enzyme preparation was also capable of degrading native, reconstituted, carp skin collagen fibrils at pH 7.5 and 25°C, and insoluble bovine tendon collagen at pH 7.5 and 30°C. α-Chymotrypsin and trypsin, each at a concentration equal to the amount of total protein in the enzyme preparation, had practically no effect on the release of bound hydroxyproline from collagen fibrils. The results corroborate the existence of a collagenolytic enzyme in the pyloric caeca of yellow-tail. (Authors)

16719. Conte, Frank P., and Edward Murray (Dept. of Zool., Oregon State Univ., Corvallis, Oregon 97331). 1973. MOLECULAR ASPECTS OF CHLORIDE CELL FORMATION IN Oncorhynchus. I. ISOLATION AND CHARACTERIZATION OF RIBOSOMES INVOLVED IN PROTEIN SYNTHESIS. Can. J. Zool., 51(6): 567-576.

The present investigation has developed techniques for the reproducible isolation of polyribosomes from gill filaments of Oncorhynchus nerka, O. kisutch, O. tshawytscha, and Salmo gairdneri. A basic pattern of aggregated complexes was resolved in microsomal and deoxycholate-treated fractions that was consistent with the ultrastructural observations made by electron microscopy. The relative amino acid incorporating activity was assessed in vivo and the association with particular polyribosomal classes was made. Gill filaments undergoing active salt secretion have smaller polysomes involved in protein synthesis than non-secreting gill filaments. Increased protein synthesis appears correlated with development of chloride cells. (Authors).

16720. Solomon, D. J. (Salmon & Freshwater Fish. Lab., Ministry of Agric., Fish. & Food, Whitehall Place, London SW1A 2HH, England). 1973. EVIDENCE FOR PHEROMONE-INFLUENCED HOMING BY MIGRATING ATLANTIC SALMON, Salmo salar (L.). Nature, 244(5413): 231-232.

16721. Gulland, J. A., and L. K. Boerema (Dept. of Fisheries, FAO, Rome, Italy). 1973. SCIENTIFIC ADVICE ON CATCH LEVELS. NOAA Fishery Bull., 71(2): 325-335.

The sustainable yield, or maximum sustainable yield, has been used to provide, on an objective scientific basis, target figures for the catches to be taken from a heavily exploited stock that is under regulation. The simple concept of sustainable yield does not, however, provide a completely adequate guide when the biological system is complex. Certain other quantities - the replacement yield, the sustainable yield from a stock in equilibrium, the maintainable yield, and the catch for desired harvesting rate - are defined which correspond more closely to the biological reality. One or other of these will provide a better guide for management, depending on the nature of the divergence from the simple model. In whale populations the major divergence is the lag between changes in adult stock and changes in recruitment; replacement yield or maintainable yield are the most useful. In many fish stocks, fluctuations in year-class strength are more important: catch for desired harvesting rate may be better. (Authors)

16722. Kato, Mamoru. 1973. THE AGE DETERMINATION OF THE MASU SALMON, Oncorhynchus masou (Brevoort), BY SCALE READING, WITH SPECIAL REFERENCE TO A CRITERION TO CLASSIFY THE AGE DURING THE FRESH-WATER LIFE. Bull. Japan Sea Fish. Res. Lab., No. 24, pp. 53-66.

The age determination method of the masu salmon, Oncorhynchus masou (Brevoort), has not yet been defined as described in the previous report. Especially it was uncertain to classify the age during the fresh-water life. Marking (fin-clipping) experiments for juveniles of the masu salmon born by artificial fertilization in autumn, 1966 were made in the Shiribetsu River, Hokkaido, draining into the Japan Sea. A part of the juveniles were released at 2_2 age in the spring of 1968, and the remainder at the 3_3 age in the spring of 1969, respectively. In 1969 and 1970, some of the marked fish were recaptured as spawners, which passed one year of marine life, in the river or neighboring seashores. The author examined the scales of these returned fishes to settle criteria for classification of the age during the fresh-water life. Two types of scales were found; one had the number of the age marks corresponding closely with the number of years (winters) passed in the fresh-water after emergence, another had additionally a false mark in the area near the focus. In number of ridges from the focus, the false mark (F_0) ranges between 4 and 8, while the actual first and second age-marks (F_1 and F_2) ranged from 8 to 18 and 21 to 26, respectively. Therefore, it is suggested that the age during the fresh-water life can be classified by the number of ridges between the focus and the latest mark during the fresh-water life. This hypothesis was applied to the scales of the maturing fishes caught in offshore of the Japan Sea in 1968 and 1969. The frequency distribution of the number of ridges showed bimodal forms with a boundary in the 18th ridge from the focus. It should be concluded that the mature fish having the ridges more than 19 was the 4_3 age, while the fish having less than 18 was the 3_2 age. (Auth.)

16723. Bayliff, William H. 1973. MATERIALS AND METHODS FOR TAGGING PURSE SEINE- AND BAITBOAT-CAUGHT TUNAS. Inter-American Tropical Tuna Commission Bulletin, 15(6): 465-488.

The percentages of return of purse seine-tagged yellowfin and baitboat-tagged yellowfin and skipjack subjected to various combinations of treatments were tested statistically to determine the effects of the treatments. For yellowfin the percentages of return differed among sets or dates of release, and were higher for double-tagged fish, larger fish, and fish released soonest during each set. For skipjack the percentages of return differed among dates of release, and were higher for single-tagged fish and fish tagged in plastic-covered cradles. (Auth.)

16724. Thorson, Lee C., and Mary Ellen Engett (Scientific Publications Staff, NMFS, Seattle, Washington). 1973. FISHERY PUBLICATIONS, CALENDAR YEAR 1965: LISTS AND INDEXES. NOAA Technical Report NMFS CIRC-383, 12 p.

16725. Nelson, Joseph S. (Dept. of Zool., The Univ. of Alberta, Edmonton, Alberta, Canada). 1973. MORPHOLOGICAL DIFFERENCES BETWEEN THE TELEOSTS Couesius plumbeus (LAKE CHUB) AND Rhinichthys cataractae (LONGNOSE DACE) AND THEIR HYBRIDS FROM ALBERTA. Reprint from Journal of Morphology, 139(2): 227-238.

Marked external and osteological differences exist between the related cyprinids Couesius plumbeus and Rhinichthys cataractae. C. plumbeus differs from R. cataractae in several external features, such as eye size and mouth shape, any one of which permits identification of individuals. C. plumbeus has postcleithral and nasal bones while R. cataractae does not. Many differences in bone shape also exist. Natural hybrids between the two species from Upper and Lower Kananaskis reservoirs, southwestern Alberta, are intermediate in the average of their external and osteological characters. Some characters in the hybrids, however, are so variable that they fall within the range of both parental species. An individual hybrid may resemble one parental species in one diagnostic character and the other parental species in another. The largest individuals known of the three forms from the Kananaskis system are hybrids. (Auth.)

16726. Goodyear, C. Phillip, Claude E. Boyd, and Robert J. Beyers (Savannah River Ecol. Lab., Aiken, South Carolina 29801). 1972. RELATIONSHIPS BETWEEN PRIMARY PRODUCTIVITY AND MOSQUITOFISH (Gambusia affinis) PRODUCTION IN LARGE MICROCOSMS. Limnol. & Oceanogr., 17(3): 445-450.

Mosquitofish were raised in 244-cm-diameter pools which were fertilized with different levels of commercial fertilizer to establish various levels of primary productivity; this was measured during summer by both O_2 and pH-CO_2 estimates. Mosquitofish and the residues of organic matter accumulated in the pool bottoms were harvested at the end of the experiment. Mosquitofish production was highly correlated with net and gross primary productivity as measured by both techniques. The production of mosquitofish was more highly correlated with the amount of organic nitrogen in the residue than with the total amount of residue in each microcosm. (Authors)

16727. Kleerekoper, H., J. B. Waxman, and J. Matis (Texas A&M Univ., Dept. of Biol., College Sta., Texas 77843). 1973. INTERACTION OF TEMPERATURE AND COPPER IONS AS ORIENTING STIMULI IN THE LOCOMOTOR BEHAVIOR OF THE GOLDFISH (Carassius auratus). J. Fish. Res. Bd. Canada, 30(6): 725-728.

Movements of single goldfish (Carassius auratus) were monitored in a free choice situation comprising zones of laboratory water or copper-containing water (0.010 ppm as $CuCl_2$) each at two temperatures, 21.1 $\pm$ .1 and 21.5 $\pm$ .1 C. Fish entered the copper zone at 21.1 C significantly less frequently and spent less time there per entry as compared to the noncopper zone ("avoidance" behavior). The copper zone at 21.5 C became significantly "attractive" to the fish in terms of both frequency of entry and time spent. In the same terms, laboratory water at 21.5 C was "attractive" to the fish but became significantly more so in the presence of copper ions at the concentration of 0.010 ppm. (Authors)

16728. Johnson, Sterling K., and Wilmer A. Rogers (Dept. of Fish. and Allied Aquaculture, Agric. Exp. Sta., Auburn Univ., Auburn, Alabama 36830). 1972. Ergasilus clupeidarum sp. n. (COPEPODA: CYCLOPOIDA) FROM CLUPEID FISHES OF THE SOUTHEASTERN U. S. WITH A SYNOPSIS OF THE NORTH AMERICAN Ergasilus SPECIES WITH A TWO-JOINTED FIRST ENDOPOD. J. Parasit., 58(2): 385-392.

Ergasilus clupeidarum sp. n. is described from female specimens taken from gills of Alosa chrysochloris, A. aestivalis, Dorosoma cepedianum, and D. petenense, all from southeastern U. S. waters. The new species has a 2-segmented first endopod which relates it to several Ergasilus species with the same character. A synopsis is presented that reviews these species and makes some taxonomic revisions. Included are E. cerastes, E. clupediarum sp. n., E. chatauquaensis, E. elongatus, E. felichthys comb. n., E. megaceros, E. mugilus (?), E. tenax, and E. versicolor. (Authors)

16729. Carr, William E. S., and Clayton A. Adams (Dept. of Zool., Univ. of Florida, Gainesville, Florida 32601). 1973. FOOD HABITS OF JUVENILE MARINE FISHES OCCUPYING SEAGRASS BEDS IN THE ESTUARINE ZONE NEAR CRYSTAL RIVER, FLORIDA. Trans. Amer. Fish. Soc., 102(3): 511-540.

Quantitative gravimetric analyses of stomach contents were carried out on juveniles of 21 species of fishes that cohabit seagrass beds near Crystal River, Florida. Our analyses were based on dry weights of food items and are expressed as percent of total stomach contents. The species analyzed were Harengula pensacolae, Opisthonema oglinum, Anchoa hepsetus, Anchoa mitchilli, Synodus foetens, Strongylura marina, Hyporhamphus unifasciatus, Oligoplites saurus, Trachinotus falcatus, Eucinostomus gula, Haemulon plumieri, Orthopristis chrysoptera, Bairdiella chrysura, Cynoscion nebulosus, Diplodus holbrooki, Lagodon rhomboides, Microgobius gulosus, Chasmodes saburrae, Menidia beryllina, Tronectes maculatus, and Sphoeroides nephelus. Analyses of stomach contents taken from small, sequentially arranged size classes enabled us to delineate discrete ontogenetic changes in food habits in many of the species. In the 15 species in which planktivorous feeding stages were detected, only zooplankters were consumed in measurable amounts. Juveniles of H. pensacolae, O. oglinum, A. hepsetus, A. mitchilli, and M. beryllina were almost exclusively planktivorous throughout most of the available size ranges and exhibited a distinct selection for molluscan veliger larvae. Copepods, mysids, and larval crustaceans were the principal plankters consumed by juveniles of other species. Only three species, D. holbrooki, L. rhomboides, and H. unifasciatus, exhibited herbivorous feeding stages. In both D. holbrooki and L. rhomboides, the herbivorous habit began quite early in juvenile development and followed a preliminary planktivorous stage. Larger specimens of L. rhomboides became carnivorous, where adults of D. holbrooki (and H. unifasciatus)were herbivorous. Juveniles of eight species exhibited carnivorous feeding stages, consuming primarily benthic invertebrates. Of these species, O. saurus, H. plumieri, O. chrysoptera, and B. chrysura consumed primarily shrimp and mysids; E. gula and T. maculatus utilized primarily polychaetes; C. saburrae consumed primarily amphipods; and T. falcatus consumed mainly crabs after utilizing mysids, small shrimp, and fishes in earlier feeding stages. In O. saurus, an intermediate stage was apparent in which material obtained from a "cleaning" habit made an important contribution to the diet. Juveniles of two species, L. rhomboides and C. nebulosus, exhibited carnivorous stages in which both benthic invertebrates and small fishes were important in the diet. Specimens of S. marina and S. foetens were primarily piscivorous. Detritus was an important dietary component in six species. In S. nephelus, M. gulosus, and C. saburrae, detritus was a major food item throughout most of the available size ranges. In M. beryllina, detritus was the major food item in the smallest size class examined. Appreciable amounts of detritus were also consumed by juveniles of O. oglinum and adults of H. unifasciatus. (Authors)

16730. Nikol'skiy, G. V., and N. K. Kanevskaya (A. N. Severtsov Inst. of Evolutionary Morphology and Animal Ecology (IEMEZh), USSR Acad. of Sciences, Moscow, USSR). 1972. SOME DATA ON THE RELATIONSHIP BETWEEN THE RANGE OF VARIABILITY OF CHARACTERS AND THE KARYOTYPES OF STURGEONS (FAM. ACIPENSERIDAE). J. Ichthyol., 12(3): 382-388.

Comparisons of the range of variability of a number of characters of sturgeons, expressed by means of the standard deviation and the coefficient of variation, have shown that variability is greater in species with 120 chromosomes than in species with 60 chromosomes. Within each of the two groups compared, variability is greater in species which occur in higher latitudes i.e., under harsher conditions.

16731. Gaines, J. L. 1971. STRIPED BASS KILL. Newsl. SE Coop. Fish Disease Project 8: 1.

History, pathology, and control measures for a nematode, Goezia sp, which has destroyed populations of striped bass in lakes of Northern Florida.

16732. Krenkel, Peter A., Margaret M. Eagle, and Fred G. Ziegler (Dept. of Environ. and Water Resources Engineering, Vanderbilt Univ., Nashville, Tenn. 37235). 1973. MERCURY IN THE ENVIRONMENT. Trans. NE Fish & Wildl. Conf., May 14-17, 1972, Ellenville, New York.

The history of recent mercury pollution is traced through Japan, Sweden, Canada and the United States. Natural levels of mercury in rocks, water, air and organisms are discussed with emphasis on the ability of organisms to concentrate mercury from water or lower food-chain organisms. Amounts of mercury contributed to the environment by man are compared with amounts released by natural means. Methylation, the process by which microorganisms convert inorganic mercury to the more toxic methylmercury, is described. The basis for standards established for allowable amounts of mercury in fish is questioned especially with respect to the measurement of mercury rather than methylmercury in the samples. (Authors)

16733. Cole, C. F. (Mass. Univ., Dept. of Forestry and Wildl. Mgmt, Amherst, Massachusetts). 1972. EFFECTS OF WATER DIVERSION ON ESTUARINE FAUNA IN THE MERRIMACK RIVER, MASSACHUSETTS. Available from the Nat'l Tech. Information Serv. as PB-218 675, $3.00 paper copy, $0.95 in microfiche. Mass. Water Resources Res. Center, Final Report, 10 p., 5 ref. OWRR-A-038-MASS (1); Selected Water Resources Abstracts, 6(12): p. 71.

Some of the biological effects were investigated of a proposed Corps of Engineers' freshwater diversion to the Boston Mass. water supply from the Merrimack River. The project complemented an ongoing Corps study on riverine fauna by examining nearshore fisheries resources including yellowtail flounder, winter skate and sand dab. Detrital discharge by the river is of probable importance in the nearshore benthic food web supporting large populations of yellowtail flounder and other benthic fishes. A year long sampling showed no major change in the benthic piscine community since 1963. A survey of anadromous fish passage facilities on the river revealed badly deteriorated ladders at the Lawrence and Lowell dams. The proposed diversion of water may reduce attraction capabilities for returning shad, Atlantic salmon and alewives and thereby reduce probable successful reintroductions and ladder restorations.

16734. Boyd, Claude E. (Dept. of Fish. & Allied Aquacultures, Agric. Exp. Sta., Auburn Univ., Auburn, Alabama 36830). 1973. SUMMER ALGAL COMMUNITIES AND PRIMARY PRODUCTIVITY IN FISH PONDS. Hydrobiologia, 41(3): 357-390.

The paper presents data on primary productivity and phytoplankton communities in new experimental ponds which received the following treatments; ammonium nitrate and triplesuperphosphate, triplesuperphosphate, cracked corn (10% crude protein) and Auburn No. 3 fish feed (36% crude protein). Comparative data on algal communities were also obtained from production ponds which received feeds or fertilizers. Basic ecological data on macro-algae are also presented. All nutrient additions to experimental ponds resulted in higher levels of gross photosynthesis and greater concentrations of chlorophyll α than were found in the control treatments. Fertilization with both nitrogen and phosphorus gave the highest values. Chlorophyll α and gross photosynthesis were higher in ponds receiving high protein content feed (Auburn No. 3) than in ponds to which low protein content feed (corn) was applied. Persistent blooms of blue-green algae occurred in ponds receiving nitrogen and phosphorus fertilization. Phosphorus only fertilization produced blooms of blue-greens, but these blooms did not persist as in the ponds to which nitrogen was also added. Control ponds were dominated by green algae. Blue-green algae were seldom abundant in feed treatments. Production ponds had high level of gross photosynthesis and large concentrations of chlorophyll α. Many of the production ponds which received feed applications developed heavy blooms of blue-green algae. The major species of blue-green algae observed in the present study were Oscillatoria sp., Raphidiopsis curvata, Anacystis nidulans, A. aeruginosa, Spirulina sp., and Anabaena circinalis. Heterocyst bearing forms, which can presumably fix nitrogen, were seldom noted in ponds that received continuous additions of nitrogen from fish feeds. Macro-algae are abundant in many fish ponds. Data illustrating the competition of macro-algae with phytoplankton are presented. (Auth.)

16735. Fast, Arlo W. (Dept. of Fish. and Wildl., Mich. State Univ., East Lansing, Michigan). 1973. EFFECTS OF ARTIFICIAL DESTRATIFICATION ON PRIMARY PRODUCTION AND ZOOBENTHOS OF EL CAPITAN RESERVOIR, CALIFORNIA. Water Resources Research, 9(3): 607-623.

El Capitan reservoir was continually and artificially mixed by using compressed air during the summers of 1965 and 1966. Mixing and reservoir volume increases resulted in more uniform physical and chemical conditions, aerobic conditions throughout the lake, increased primary production, increased depth distributions of zoobenthos, and zoobenthos population increases. Increased primary production was related to a decrease in algal depth distribution. This decrease was caused by incomplete destratification, since thermal microstratification persisted near the lake surface. Zoobenthos were distributed throughout the lake during mixing, whereas they were confined to shallow depths during well-stratified times. Water volumes increased three-fold during the study and greatly confounded interpretation of the mixing effects. (Auth.)

16736. Williams, Ernest H., Jr. (Dept. of Fish. & Allied Aquaculture, Agric. Exp. Sta., Auburn Univ., Auburn, Alabama 36830). 1972. Oodinium cyprinodontum Lawler (DINOFLAGELLIDA) ON Fundulus similis (Baird and Girard) AND Cyprinodon variegatus Lacépède FROM THE GULF OF MEXICO. Alabama Marine Resources Bull. No. 8, pp. 32-33.

Oodinium cyprinodontum Lawler (Dinoflagellida), is reported for the first time from the Gulf of Mexico. It was found on the sheepshead minnow, Cyprinodon variegatus Lacépède, and on the longnose killifish, Fundulus similis (Baird and Girard), the latter a new host record. (Auth.)

16737. Kesteven, G. L. (Fish. Res. and Development Project, Apartado Postal M-10778, Mexico). 1973. MANUAL OF FISHERIES SCIENCE. PART 1. AN INTRODUCTION TO FISHERIES SCIENCE. FAO Fisheries Technical Paper No. 118, 43 p., distribution restricted.

16738. Manooch, Charles S., III (N. C. State Univ., Zool. Dept., Raleigh, North Carolina 27606). 1973. FOOD HABITS OF YEARLING AND ADULT STRIPED BASS, Morone saxatilis (Walbaum), FROM ALBEMARLE SOUND, NORTH CAROLINA. Chesapeake Science, 14(2): 73-86.

A total of 1,094 yearling and adult striped bass, Morone saxatilis, were collected from Albemarle Sound, North Carolina, from July 1970 through August 1971. Specimens were captured by gill nets, hook and line, trawl, pound nets, and purse seine, and ranged in size from 125 to 714 mm total length. Approximately 77 percent of the fish contained food consisting of 3,249 individual organisms. Twenty-five specific groups of food organisms were identified. These included fifteen species of fish and ten taxa of invertebrates. Fish were the main foods of striped bass and occurred in 93 percent of the stomachs containing food. Predominant species identified were Atlantic menhaden, Brevoortia tyrannus, blueback herring, Alosa aestivalis, and bay anchovy, Anchoa mitchilli. Invertebrates were of secondary importance and consisted mainly of blue crabs, Callinectes sapidus, penaeid shrimp, and gammarid amphipods. Food habits varied substantially with size of fish, area, and season of collection. Cannibalism was rarely encountered. Only two yearling striped bass from over two hundred examined (1 percent) contained young Morone saxatilis. No striped bass were found in larger specimens. Striped bass are capable of consuming clupeids which are approximately 60 percent of striped bass length. Striped bass generally fed on smaller fish which averaged 20 percent of the predator's length. Size availability of forage is an important factor in Albemarle Sound. Striped bass preferred the soft-rayed species which generally occurred as juveniles in the sound. (Auth.)

16739. Engett, Mary Ellen, and Lee C. Thorson (Scientific Publications Staff, NMFS, Seattle, Oregon). 1973. FISHERY PUBLICATIONS, CALENDAR YEAR 1968: LISTS AND INDEXES. NOAA Technical Report NMFS CIRC-380, 24 p.

16740. Derickson, W. Kenneth, and Kent S. Price, Jr. (Univ. of Delaware, Coll. of Marine Studies, Newark and Lewes, Delaware). 1973. THE FISHES OF THE SHORE ZONE OF REHOBOTH AND INDIAN RIVER BAYS, DELAWARE. Trans. Amer. Fish. Soc., 102(3): 552-562.

Twenty collections from 18 stations in Indian River and Rehoboth bays, June 1968 to April 1970, yielded 41,286 fishes representing 46 species. Five species, ecologically important as food for many local commercial species, comprised 89% of the total catch and were, in order of abundance: Fundulus majalis, Menidia menidia, Fundulus heteroclitus, Pseudopleuronectes americanus, and Anchoa mitchilli. Combined average biomass estimates for the five species were 55 kg/ha and 28 kg/ha for Rehoboth Bay in 1968 and 1969 respectively, and 76 kg/ha and 37 kg/ha for Indian River Bay in 1968 and 1969 respectively. Greatest species diversity and abundance occurred in summer, probably because this is when many of these species collected use these bays as nursery and feeding grounds. F. majalis, M. menidia, F. heteroclitus, P. americanus, Cyprinodon variegatus, and Syngnathus fuscus apparently reside in these waters and spawn there during the spring and summer. Juveniles of many commercially important middle Atlantic species were also found in the bays during these seasons. P. americanus were the only fish available in any quantity to commercial and sport fisheries in the study areas. Other commercial fishes typical of the middle Atlantic region, such as Brevoortia tyrannus, Pomatomus saltatrix, and Paralichthys dentatus, were either scarce or occurred sporadically. Changes in species composition and numbers that have occurred in these bays during the past 12 years are probably the result of increased pollution and general environmental degradation. (Authors)

16741. Menzel, Bruce W., and Mark S. Boyce (Dept. of Zool. and Entomol, Iowa State Univ., Ames, Iowa). 1973. FIRST RECORD OF THE PEARL DACE, Semotilus margarita (Cope) FROM IOWA. Iowa State Journal of Research, 47(4): 245-248.

Specimens were collected from a small tributary to the Shellrock River (Cedar River drainage) in Worth County. The species is also known from the Cedar River in Minnesota. (Authors)

16742. Kabata, Z. (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. THE SPECIES OF Lepeophtheirus (COPEPODA: CALIGIDAE) FROM FISHES OF BRITISH COLUMBIA. J. Fish. Res. Bd. Canada, 30(6): 729-759.

Description of, and keys to, 10 species of Lepeophtheirus (Copepoda: Caligidae), parasitic on fishes of British Columbia, are given. Diagnostic value of different morphological details is discussed. Nine of the species included were previously known (L. bifidus, L. breviventris, L. hospitalis, L. nanaimoensis, L. parvicruris, L. parviventris, L. paulus, L. pravipes, and L. salmonis) and one is described for the first time (L. oblitus). (Auth.)

16743. Galasun, P. T. (Ukrainian Fish. Res. Inst. (UkrNIIRKh, Kiev) USSR). 1972. THE MORPHOLOGICAL CHARACTERS OF RAINBOW TROUT, Salmo gairdneri irideus Gibbons, REARED IN POND FARMS OF THE WESTERN REGIONS OF THE UKRAINE. J. Ichthyol., 12(2): 204-209.

A study was made of 181 specimens of the rainbow trout reared at the "Okonsk" farm in the Poles'ye (which has an artesian water supply), and at two Carpathian farms "Zhdymir" and "Shipot", at altitudes of 320 and 382 m above sea level respectively, which draw their water supplies from mountain rivers and watercourses. A biometric analysis has shown that irrespective of the different temperature regimes of the ponds of the farms studied, there was no real difference between trout from the "Okonsk", "Zhdymir" and "Shipot" farms. However, in the trout from the "Okonsk" farm a tendency towards an increase in some characters, such as the greatest and least body depth, was noted. Sexual dimorphism is weakly expressed in yearlings but a real difference is observed in fish of 4+ in eight of the twelve characters compared. The variation in morphological characters increases with age, particularly in the males.

16744. Magnuson, John J. (Lab. of Limnol., Dept. of Zool., Univ. of Wisconsin, Madison, Wisconsin 53706). 1973. COMPARATIVE STUDY OF ADAPTATIONS FOR CONTINUOUS SWIMMING AND HYDROSTATIC EQUILIBRIUM OF SCOMBROID AND XIPHOID FISHES. NOAA Fishery Bull., 71(2): 337-356.

Scombroid fishes swim continuously with pectoral fins extended as lifting hydrofoils to counter their weight in water. Their gas bladder is often reduced or absent. Typical speeds were observed from seven species and compared with the speeds expected from them to maintain hydrostatic equilibrium. The expected speeds were computed from a model I developed using data on the listing area of extended pectoral fins and the weight of the fish in water. Lifting areas of the pectoral fins were determined from photographs of dead fishes. Mass-length relations were determined and converted to weight in water from data on water density and fish density. Typical observed speeds varied among species from 0.33 to 2.19 lengths/sec. Scombroids of the same fork length differed greatly in mass, density, and pectoral fin areas. Swimming speed required for maintaining hydrostatic equilibrium should be greater for fishes with greater mass, higher density, and smaller pectorals. Expected speeds were computed. They were highly correlated with observed speeds, $r = +0.89$. Thus, the model accurately predicted typical swimming speeds of scombroids, which suggests that variations in mass, density, and the lifting area of the pectoral fins, through the mechanism of maintaining hydrostatic equilibrium, can account for about 80% of the variation in typical swimming speeds. Expected speeds (centimeters per second) generated from the model either increased with fork length or reached a maximum and declined for larger fish. The latter pattern occurred if gas bladders were relatively larger in older fish or even absent in younger fish. Scombroids with faster typical speeds have larger dark muscles and higher concentrations of blood hemoglobin than those with slower speeds. Differences in body shape were not closely related to differences in typical speeds. Larger fishes should have more difficulty maintaining a speed which is sufficient for hydrostatic equilibrium without a gas bladder or large pectoral fins. The occurrence of gas bladders and long pectoral fins were compared for small, medium, and large scombroid and xiphoid fishes. Both were more common among larger species. Each species with a maximum mass $\leqslant$ 70 kg had a gas bladder while only 26% of those species $\leqslant$ 6 kg had a gas bladder. Further analyses suggested that a gas bladder and large pectorals may be increasingly more important for large species if they are to swim at energetically prudent speeds. (Auth.)

16745. Balakhnin, I. A., and N. P. Galagan. 1972. DISTRIBUTION AND SURVIVAL RATE OF INDIVIDUALS WITH DIFFERENT TRANSFERRIN TYPES AMONG CARP OFFSPRING FROM VARIOUS COMBINATIONS OF PARENTS. Hydrobiological Journal, 8(3): 41-45.

The inheritance of transferrin type is a codominant character in carp and there is a distinct break in the distribution of some phenotypes. The data confirm Ashton's hypothesis that individuals heterozygous with respect to transferrins are the most viable.

16746. McCraren, Joseph P. (Warmwater Hatchery Biologist Center, Nat'l. Fish Hatchery, Tishomingo, Oklahoma 73460). 1972. CHANNEL CATFISH VIRUS DISEASE (CCV): A CURRENT REVIEW. Proc. 52nd Ann. Conf. Wes. Assoc. Game and Fish Comm., pp. 528-537.

The channel catfish virus disease (CCV) is a highly virulent and communicable disease of fry and fingerlings, inflicting losses of up to 100 percent in affected lots. The etiological agent is a herpes virus that apparently affects only channel catfish under hatchery conditions. The virus has thus far been reported from 23 epizootics occurring in nine different states. Vertical transmission is suspected but definitive methods for carrier detection have not been developed. Control at the present time is dependent upon avoidance, quarantine, and disinfection. (Auth.)

16747. Smith, Philip W. (Natural History Survey, Urbana, Illinois). 1973. A KEY TO THE FISHES OF ILLINOIS. Dept. of Conservation, State of Illinois Fish. Bull. No. 6, 43 p.

16748. Kabata, Z., and B. Cousens (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. LIFE CYCLE OF Salmincola californiensis (Dana 1852) (COPEPODA: LERNAEOPODIDAE). J. Fish. Res. Bd. Canada, 30(7): 881-903.

A description is given of the life cycle of Salmincola californiensis (Copepoda: Lernaeopodidae), studied by continuous observation of developing parasites and by intermittent examination of infected sockeye salmon (Oncorhynchus nerka). The cycle consists of six stages: copepodid (free-swimming), four chalimus stages (attached by second maxillae to frontal filament), and adult (attached by bulla). The copepodid settles on the fish and uncoils its frontal filament. Each successive chalimus stage reattaches the filament during moulting, but chalimus IV breaks off, searches for the site of final attachment, and excavates an implantation cavity for the bulla. The male cycle is similar but its chalimus IV is of shorter duration and soon moults into the male adult, actively searching for the female. Morphology of all stages is described in detail. Some comments are made on life cycles in Caligoida. (Authors)

16749. Yoshikoshi, Kazuma. 1972. EFFECTS OF HORMONAL SUBSTANCES ON PLASMA PROTEIN OF GOLDFISH, WITH SPECIAL REFERENCE TO THE GONADAL MATURATION. Bull. Fac. Fish. Nagasaki, No. 34, pp. 63-68. In Japanese with English abstract, tables, and figs.

Plasma protein fractions and total protein in plasma in relation to the gonadal maturation and the effects of exogenous estrogenic substances (diethylstilbestrol and estradiol-17β), gonadotropin (a mixture of human chorionic gonadotropin and mammalian anterior pituitary extracts), androgenic substances (testosterone propionate and methyltestosterone), and progesterone on plasma protein fractions and total protein in plasma of goldfish were investigated. Conspicuous elevation of the IVth fraction level in female fish was observed in breeding season. The level of total protein was increased in breeding season and was higher in female fish than in the male. Conspicuous elevation of the levels of total protein and the IIIrd and IVth fractions was observed by estrogen treatment. The elevation of the IIIrd fraction level by estrogen treatment was lowered by simultaneous administration of gonadotropin, and the pattern obtained from immature fish was similar to that of normal mature female. The level of total protein was also lowered slightly by the same treatment. Slight elevation of total protein and IVth fraction levels in female fish in breeding season was observed by gonadotropin treatment. No remarkable changes were detected on plasma protein after the administration of androgenic substances and progesterone. From these results it is suggested that both endogenous estrogen and gonadotropin control over the ovarian maturation through regulation of plasma protein constituents. (Auth.)

16750. Stolk, A. 1962. MUSCULAR DYSTROPHY IN FISHES, AMPHIBIANS AND REPTILES. Acta Morphologica Neerlando-Scandinavica (Netherlands), pp. 117-139.

It is obvious by examination of the references that this author is the first investigator who showed interest in the presence of muscular dystrophy in poikilothermic vertebrates. He found it to be fairly widely distributed among 71 species belonging to 28 families of reptiles, amphibians, and fishes living on land, fresh and salt water. Age, but not sex, influence the occurrence of this disease. In most cases, animals with muscular dystrophy were of middle age or elderly. Disease is characterized by changes in the consistency of the muscle fibres. Concentration of acid phosphatase was increased in atrophied muscles and in the connective tissue which invaded the abnormal muscle fibres. There is a table which lists all the animals by species with muscular dystrophy. Etiology of the disease is unknown but there are indications that the disease is caused by an aberration of the neighboring connective tissue. -- S. F. Snieszko

16751. Regier, H. A., and W. L. Hartman (Univ. of Toronto, Toronto, Ontario, Canada). 1973. LAKE ERIE'S FISH COMMUNITY: 150 YEARS OF CULTURAL STRESSES. Science, 180(4092): 1248-1255.

16752. McErlean, Andrew J., Susan G. O'Connor, Joseph A. Mihursky, and Charles I. Gibson (Dept. of Environ. Res., Chesapeake Biol. Lab., Univ. of Maryland, Prince Frederick, Maryland). 1973. ABUNDANCE, DIVERSITY AND SEASONAL PATTERNS OF ESTUARINE FISH POPULATIONS. Estuarine and Coastal Marine Science, 1(1): 19-36.

Fish populations of the middle Patuxent Estuary in Maryland were sampled over a four-year period with quarterly frequency using three sampling gears: haulseine, beam trawl and otter trawl. Data from each quarterly collection at 50 stations were examined using a three-dimensional grid to check for possible effect due to a steam electrical generating station (s.e.s.). No marked s.e.s. effect was noted. Trend analyses were performed for the number of species, number of individuals and several diversity indices. All analyses show strong seasonal cycles that are related to the nursery function of the estuary and to migratory activities. Regression lines fitted to the cyclic-trend patterns all show decreasing functions with time. These patterns suggest that a loss in diversity, as measured by these indices, has occurred. These changes are interpreted as being caused by a true loss of species in some cases and a shift in population structure in others. Possible explanations for the trends are examined and the implication of the trends are discussed. Should these trends continue, structural complexity of an already simple system will be reduced and increased amounts of energy may be diverted to dominant forms. The altered system, because of the loss of buffering capacity provided by alternate food web interconnections, may become subject to crashes and booms. (Authors)

16753. Smith, Raymond C., John E. Tyler, and Charles R. Goldman (Visibility Lab., Scripps Inst. of Oceanogr., Univ. of Calif., San Diego, La Jolla, California). 1973. OPTICAL PROPERTIES AND COLOR OF LAKE TAHOE AND CRATER LAKE. Limnol. & Oceanogr., 18(2): 189-199.

Spectral irradiance has been measured as a function of depth in Crater Lake, Oregon, and Lake Tahoe, California. In Lake Tahoe, Secchi disk observations and submarine photometer measurements have been recorded year round since July 1967. Also, in Lake Tahoe, beam transmittance has been measured as a function of depth. From these data the radiant energy input and certain optical properties of the two lakes are presented. Since color is a principal esthetic feature of these lakes, a complete color analysis is also presented. This information provides an objective standard with which to compare possible future changes in the optical properties and in the esthetic appearance of Crater Lake and Lake Tahoe. The method can be applied generally to quantify the optical deterioration of any aquatic habitat and can detect such deterioration before it is noticeable by casual visual observation. (Authors)

16754. Hara, Toshiaki J., Y. M. Carolina Law, and B. R. Hobden (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada R3T 2N6). 1973. COMPARISON OF THE OLFACTORY RESPONSE TO AMINO ACIDS IN RAINBOW TROUT, BROOK TROUT, AND WHITEFISH. Comp. Biochem. Physiol., 45(4A): 969-977.

The olfactory apparatus and the bulbar electrical responses induced by nasal infusion of amino acid solutions were compared among three salmonid species, rainbow trout, brook trout and whitefish. Morphology of the olfactory organ was similar in all species examined, except that the peripheral olfactory organ of whitefish was slightly smaller. The threshold concentration for the most effective amino acids ranged from 10^{-7} to 10^{-8} M in rainbow and brook trout and was higher in whitefish. Olfactory bulbar response spectra to amino acids were similar in all species. However, correlation was slightly higher between rainbow and brook trout ($r = 0.89$) than between rainbow trout and whitefish ($r = 0.82$). (Authors)

16755. Bishop, Frank G. (Reg. Fishery Biologist, Peace River, Alberta, Canada). 1973. RANGE EXTENSION OF THE DOLLY VARDEN, Salvelinus malma (Walbaum), IN ALBERTA. Canad. Fld Nat., 87(1): p. 52.

16756. Hughes, George M. (Res. Unit for Comp. An. Resp., The University, Bristol, England). 1973. RESPIRATORY RESPONSES TO HYPOXIA IN FISH. American Zoologist, 13(2): 475-489.

Hypoxia is discussed in the widest sense, i.e., as the conditions under which cells suffer a lack of oxygen. From a consideration of the transfer of oxygen from the water to the cellular sites as a series of resistances, it is suggested that hypoxia can result from an increase in resistance anywhere along the chain, and possible types of hypoxia in fish are defined from this point of view. More detailed discussion is given in relation to (1) interference with gas transfer at the gill surface; (2) reduction in the blood O_2 carrying capacity; (3) modifications in the cardiac and ventilatory frequencies and in the coupling between these two rhythms, and (4) the time course of the hypoxic stimulus. It is concluded that most of the increase in knowledge of hypoxia during the past ten years can be fitted into known theoretical frameworks, but there is still a great need for measurements of oxygen tension at all levels in the respiratory chain; attention needs to be directed to both diurnal and seasonal variations and especially to long-term changes in those environmental conditions which tend to result in hypoxia. (Auth. synopsis)

16757. Wickham, Donald A., John W. Watson, Jr., and Larry H. Ogren (NMFS, Southeast Fish. Center, Pascagoula, Mississippi 39567). 1973. THE EFFICACY OF MIDWATER ARTIFICIAL STRUCTURES FOR ATTRACTING PELAGIC SPORT FISH. Trans. Amer. Fish. Soc., 102(3): 563-572.

Field experiments were conducted in the northeastern Gulf of Mexico off Panama City, Florida to evaluate the feasibility of using man-made midwater structures for attracting pelagic game fish to improve sportfishing catch rates. Significantly greater catches of little tunny (Euthynnus alletteratus), king mackerel (Scomberomorus cavalla), and dolphin (Coryphaena hippurus) were made around experimental structure sites than in adjacent control areas when equal experimental fishing effort was used. Multiple structures attracted larger numbers of coastal pelagic bait fish and produced larger catches of pelagic game fish than single-structure units. The distance offshore or water depth of structure locations affected both the species of fish attracted and the number of fish caught. Charter fleet vessels fished around one of the experimental structures for several hours and reported total numbers of pelagic game fish caught and catch rates at least double those in "other areas" for that day. (Authors)

16758. Lyagina, T. N. (Dept. of Ichthyol., Moscow State Univ., USSR). 1972. THE SEASONAL DYNAMICS OF THE BIOLOGICAL CHARACTERISTICS OF THE ROACH [Rutilus rutilus (L.)] UNDER CONDITIONS OF VARYING FOOD AVAILABILITY. J. Ichthyol., 12(2): 210-226.

A study has been made of the dynamics of length and weight increase, condition, fatness, the relative weight of the liver and the maturity of the roach of the same age from April to October in different years, under different conditions of food availability. The nature of the variations of the first four characteristics is unstable and depends mainly on fattening conditions in the year concerned. The nature of the variations of the liver index is similar, whereas the maturity coefficient is identical in different years. Clearly the dynamics of these characteristics is largely determined by endogenous factors. Partial elimination of the eggs is noted when growth conditions deteriorate sharply in the middle of the feeding period. (Auth.)

16759. Hodgins, H. O., F. L. Wendling, B. A. Braaten, and R. S. Weiser (NMFS, Seattle, Washington 98112). 1973. TWO MOLECULAR SPECIES OF AGGLUTININS IN RAINBOW TROUT (Salmo gairdneri) SERUM AND THEIR RELATION TO ANTIGENIC EXPOSURE. Comp. Biochem. Physiol., 45(4B): 975-977.

Both large-molecule and small-molecule agglutinins have been found in rainbow trout serum. Only the large-molecule agglutinin was induced by exposure to antigen. (Authors)

16760. Thomas, David L., and Barry A. Smith (Ichthyol. Associates, West Brook Lane, Absecon, New Jersey 08201). 1973. STUDIES OF YOUNG OF THE BLACK DRUM, Pogonias cromis, IN LOW SALINITY WATERS OF THE DELAWARE ESTUARY. Chesapeake Science, 14(2): 124-130.

Young black drum, Pogonias cromis, were studied from collections made in the lower Delaware River and four tributary marsh creeks. Small individuals (8-15 mm TL) entered the study area in early June. They congregated in quiet waters of creeks and ditches usually over a mud bottom. Nine of 13 collections of young taken in June were from fresh water. Black drum about 30-50 mm began moving out of the upper portions of tidal creeks near the end of June and early July. By August, young were distributed throughout the study area. Individuals began moving out of the lower river and into Delaware Bay by early September, with the larger young usually leaving first. Young are common at times in the Delaware estuary. The largest single collection in this study was 112 specimens taken by seine in a ditch at Woodland Beach on July 5, 1969. Black drum ranked 13th in relative abundance for combined seine and trawl collections in the Delaware River study area in 1968 and 15th in 1969. (Authors)

16761. Emery, Alan R. (Ont. Ministry of Nat. Res., Fish & Wildl. Res. Branch, Maple, Ontario, Canada). 1973. PRELIMINARY COMPARISONS OF DAY AND NIGHT HABITS OF FRESHWATER FISH IN ONTARIO LAKES. J. Fish. Res. Bd. Canada, 30(6): 761-774.

Observations by SCUBA in Georgian Bay and Algonquin Park, Ont. indicate fish have specific habits of diurnal, crepuscular, and nocturnal activity in freshwater lakes. Of 21 species investigated, 17 either schooled or aggregated in the daytime, but only one (Osmerus mordax) schooled at night. The number of fish apparent at night in shallow water was greater than in the daytime primarily because of the influx of offshore species and lack of cover for resting diurnal species. Color changes parallel those reported in tropical oceans; at night a barred or mottled pattern was assumed by some fish resting on the bottom and bold daytime horizontal patterns faded. The parallel evolution of these color patterns in fresh and salt water suggests a strong evolutionary pressure for prey animals to disguise body shape when at rest at night, and that bold color patterns are disadvantageous when swimming at night. (Auth.)

16762. Valentine, David W., Michael E. Soule, and Paul Samollow (Dept. of Biol., Univ. of Calif. at San Diego, California). 1973. ASYMMETRY ANALYSIS IN FISHES: A POSSIBLE STATISTICAL INDICATOR OF ENVIRONMENTAL STRESS. NOAA Fishery Bulletin, 71(2): 357-370.

One of the most difficult tasks in evaluating the possible deleterious effects of multiple toxicants on natural communities is in defining subtle sublethal effects before the onset of chronic morbidity. We reason that before detectable changes in either species diversity or species abundance occur subtle changes must take place in a number of important processes, ranging from molecular to behavioral changes. Unfortunately, changes in these parameters have proven most difficult to detect with current methodology. We, therefore, have been examining the possible use of fluctuating asymmetry as a possible measure of environmental stress. Fluctuating asymmetry is simply the random deviation from perfect symmetry of any bilateral anatomical character. It is, therefore, a nonspecific measure of developmental perturbation. Using asymmetry analysis on three species of marine teleost - barred sand bass, Paralabrax nebulifer; grunion, Leuresthes tenuis; and barred surfperch, Amphistichus argenteus - from southern California and Baja California, we have been able to define two possible asymmetry trends, historical and geographic. Asymmetry values are shown to increase as we approach highly populated areas (southern California) both from the north and south and also with time within southern California. Such increases in asymmetry correlate well with the known distribution of various toxicants from this same area. (Authors)

16763. Meyer, Fred P., and Jordan Robinson (Bur. of Sport Fish. & Wildl., Fish Farming Experimental Sta., Stuttgart, Arkansas 72160). 1973. BRANCHIOMYCOSIS: A NEW FUNGAL DISEASE OF NORTH AMERICAN FISHES. Prog. Fish-Cult., 35(2): 74-77.

The first recorded occurrence of Branchiomyces sanguinis in North American fishes is described. Clinical signs associated with the fungal infections included necrosis of gill tissue, loss of vigor, weakness, and death. Species of fish infected included striped bass (Morone saxatilis) and largemouth bass (Micropterus salmoides). (Authors)

16764. European Inland Fisheries Advisory Commission. 1973. WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH. REPORT ON AMMONIA AND INLAND FISHERIES. Water Research, 7(7): 1011-1022.

In establishing water quality criteria for European inland fisheries, the effect of ammonia is an important factor to be considered. Sewage effluent, effluents from certain industries and from agriculture are common sources of ammonia in water. The harmful effects of ammonia on fish are related to the pH value and the temperature of the water due to the fact that only the un-ionized fraction of ammonia is poisonous. The un-ionized fraction increases with rising pH value, and with rising temperature. Fish differ slightly in their tolerance to ammonia depending on species. The difference in tolerance being more significant for short periods of exposure. The difference in tolerance is, however, not great enough to justify different criteria for different species. The lowest toxic concentration found for salmonids is 0.2 mg NH_3 l^{-1} (un-ionized), but other adverse effects caused by prolonged exposure are only absent at concentrations lower than 0.025 mg NH_3 l^{-1} (un-ionized). Concentrations of total ammonia which contain this amount of un-ionized ammonia vary from 19.6 mg l^{-1} (pH 7.0, 5°C) to 0.12 mg l^{-1} (pH 8.5, 30°C). The criterion should not be applied to temperatures below 5°C or to pH values above 8.5 when other factors have to be taken into consideration. (Authors)

16765. Ingham, L., and C. Arme (Dept. of Zool., Queen's Univ., Belfast, N. Ireland). 1973. INTESTINAL HELMINTHS IN RAINBOW TROUT, Salmo gairdneri (Richardson): ABSENCE OF EFFECT ON NUTRIENT ABSORPTION AND FISH GROWTH. J. Fish Biol., 5(3): 309-313.

Rainbow trout, Salmo gairdneri (Richardson), from a fish farm, were found to be infected with two cestodes, Eubothrium crassum and Proteocephalus sp. Observations are described which suggest that these parasites have no effect on fish growth or on the intestinal absorption of L-leucine and D-glucose. (Authors)

16766. Larson, D. W. (Dept. of Fish. & Wildl., Oregon State Univ., Corvallis, Oregon). 1972. COMPARATIVE LIMNOLOGY AND PHYTOPLANKTON ECOLOGY OF FOUR 'OLIGOTROPHIC' LAKES IN OREGON, U.S.A., WITH EMPHASIS ON LAKE TYPOLOGY. Northwest Science, 46(2): 149-163, OWRR-A-001-ORE (16); Selected Water Resources Abstracts, 6(12): p. 71.

The literature indicates that at least four lakes in Oregon are classified as 'oligotrophic' -- Crater (Donaldson, 1968), Odell (Newcomb, 1941; Averett, 1966), Waldo (Crater et al., 1966) and Woahink (Gahler, 1969). In comparing these lakes, considerable differences were noted concerning basin origin, surface elevation, watershed features, morphometry, optical and chemical properties, and how the lakes were being used. Despite the diversity, however, each lake featured many limnological properties (Welch, 1952; Ruttner, 1953) that denoted oligotrophy. This study evaluates the classification 'oligotrophic' as applied to the four lakes. It considers the various edaphic, morphometric, climatic, and cultural factors that acted upon the lake environments and discusses the difficulty of classifying lakes using the familiar oligotrophic-mesotrophic-eutrophic categories. Specific objectives were to document further the limnology of these unusual lakes and to determine the extent to which biological production and biomass - particularly with regard to the phytoplankton - might differ among them.

16767. Takashima, Fumio, Takashi Hibiya, and Takeshi Watanabe (Tokyo Univ. of Fisheries, Minato-ku, Tokyo, Japan). 1973. LIPID CONTENT OF HEPATOMA IN RAINBOW TROUT. Bull. Jap. Soc. Sci. Fish., 39(4): 335-341. In English.

Lipid in the hepatoma of rainbow trout, Salmo gairdneri, was analyzed histochemically, chemically and chromatographically. It was confirmed chemically that hepatic tumors contained a larger amount of lipids than the extra-nodular regions. Lipid included in the neoplastic cells appeared as a fine foam in paraffin-embedded sections and as droplets in frozen preparations. Triglycerides were the most prominent constituents in the lipid. Although ceroid pigments were recognized, they were not very abundant and could not be described as ceroidosis. (Authors)

16768. Schofield, Carl O., Jr. (Dept. of Nat. Resources, Cornell Univ., Ithaca, New York 14850). 1973. THE ECOLOGICAL SIGNIFICANCE OF AIR-POLLUTION-INDUCED CHANGES IN WATER QUALITY OF DILUTE-LAKE DISTRICTS IN THE NORTHEAST. Trans. Northeast Fish & Wildl. Conf., May 14-17, 1972 at Ellenville, N. Y., pp. 98-112.

Increasing acidity and heavy metals contamination of precipitation over the northeastern United States poses a serious threat to communities of organisms inhabiting the numerous soft-water lakes and streams of this region. Atmospheric deposition of inorganic acids and heavy metals can be sufficient to affect surface water quality in ombrotrophic regions. Resulting acidity and heavy metals levels produced are dangerously close to those known to produce chronic effects in fish such as reductions in growth, spawning activity and egg production. The known extent of this problem in the Northeast and its occurrence in other localities is reviewed. The paucity of available information in the Northeast is noted, and the need for new programs to assess the geochemical and ecological aspects of air pollution related problems is emphasized. (Auth.)

16769. Cook, David G., and Ralph O. Brinkhurst (National Museum of Natural Science, Ottawa, Canada). 1973 MARINE FLORA AND FAUNA OF THE NORTH-EASTERN UNITED STATES. ANNELIDA: OLIGOCHAETA. NOAA Technical Report NMFS CIRC-374, 23 p.

The manual includes an introduction on the general biology, an illustrated key, an annotated systematic list, a selected bibliography, and an index to the marine Oligochaeta of the East Coast of North America. The Families Naididae, Tubificidae, Enchytraeidae, and Megascolecidae are treated. (Authors)

16770. Ivanov, V. N. (Inst. of the Biol. of the Southern Seas, Ukrainian Acad. of Sciences, Sevastopol, USSR). 1972. TECHNIQUES FOR FISH CHROMOSOME PREPARATION. J. Ichthyol., 12(3): 389-396.

Published information on fish chromosome observation methods for embryonic and larval tissue and for cells of the integumentary epithelium of gills and scales, blood, gonads, etc. is presented together with the author's data on the subject. Methods for short-term and permanent preparations for karyological analysis are described together with methods for the culturing of different fish tissues. (Auth.)

16771. Ruggles, C. P., and G. E. Turner (Res. Development Branch, Fish. Serv., Dept. of the Environ. of Canada, Halifax, Nova Scotia, Canada). 1973. RECENT CHANGES IN STOCK COMPOSITION OF ATLANTIC SALMON (Salmo salar) IN THE MIRAMICHI RIVER, NEW BRUNSWICK. J. Fish. Res. Bd. Canada, 30(6): 779-786.

Data collected from 1954 to 1971 show that the recent decline in Miramichi River Atlantic salmon (Salmo salar) abundance has been accompanied by changes in the ratio of grilse to large salmon (2-sea-years and older) entering the river. From 1954 to 1962 trap samples were composed of about equal numbers of grilse and large salmon. Since 1963 the grilse catch has averaged 87%. Large declines in abundance of the fall-run grilse portion of the spawning stock occurred in 1968 and similar declines occurred in the fall-run large salmon component in 1969. An increase in commercial fishing mortality of large salmon is believed responsible for shifting the river escapement in favor of grilse. The result has been a reduction in reproductive potential and declines in the fall-run stocks of both large salmon and grilse. (Authors)

16772. Becker, C. Dale (Ecosystems Dept., Battelle Mem. Inst., Pacific Northwest Labs, Richland, Washington 99352). 1973. FOOD AND GROWTH PARAMETERS OF JUVENILE CHINOOK SALMON, Oncorhynchus tshawytscha, IN CENTRAL COLUMBIA RIVER. NOAA Fishery Bull., 71(2): 387-400.

Juvenile chinook salmon, Oncorhynchus tshawytscha, in the Hanford area of the free-flowing central Columbia River, Wash., consume almost entirely adult and larval stages of aquatic insects. Their diet is dominated by midges (Diptera: Chironomidae). By numbers, adult midges provided 64 and 58% of the diet and larval midges 17 and 18% of the diet, in 1968 and 1969, respectively. The families Hydropsychidae (Trichoptera or caddisflies), Notonectidae (Hemiptera or true bugs), and Hypogastruridae (Collembola or springtails) are of minor numerical importance with a combined utilization of 7% in 1968 and 15% in 1969. Distinctive features of food and feeding activity of juvenile chinook salmon at Hanford are fourfold: 1) the fish utilize relatively few insect groups, predominantly Chironomidae; 2) they depend largely upon autochthonous river organisms; 3) they select prey drifting, floating, or swimming in the water; and 4) they are apparently habitat opportunists to a large extent. Analyses were made of variations in diet and numbers of insects consumed between six sampling stations distributed along a 38-km section of the river. Data are provided on feeding intensity, fish lengths, length-weight relationships, and coefficients of condition. Seasonal changes in river temperature and discharge, as well as variations in regulated flow levels, are environmental features influencing feeding, growth, and emigration of fish in the Hanford environs. (Auth.)

16773. Heath, Alan G. (Dept. of Biol., Va. Polytech. Inst. and State Univ., Blacksburg, Virginia). 1973. VENTILATORY RESPONSES OF TELEOST FISH TO EXERCISE AND THERMAL STRESS. American Zoologist, 13(2): 491-503.

Exercise and thermal stress both markedly raise the oxygen demand of fish. The control of ventilation under these two conditions is apparently quite different and contrasts between species are noteworthy. Under both exercise and thermal stress, changes in respiratory pumping amplitude tend to be greater than changes in ventilatory frequency in most species. Respiratory pump uncoupling during thermal stress is frequently seen in trout but much less so in bullhead catfish or bluegills. In fish that actively ventilate the gills while swimming, the control for this probably depends on swimming muscle reflexes rather than blood humoral factors. This control mechanism may operate in a reverse fashion in fish that use ram-jet ventilation. During recovery from severe exercise and during thermal stress the control of gill ventilation is apparently humoral. Of the possible factors, blood oxygen and possibly also pH are considered to be the most important. Evidence is summarized that suggests the error detector is on the arterial side of the gas exchanger. (Auth. synopsis)

16774. Landry, Andre M., Jr., and Kirk Strawn (Dept. of Wildl. & Fish. Sciences, Texas A&M Univ., College Sta., Texas 77843). 1973. ANNUAL CYCLE OF SPORTFISHING ACTIVITY AT A WARMWATER DISCHARGE INTO GALVESTON BAY, TEXAS. Trans. Amer. Fish. Soc., 102(3): 573-577.

A survey of sportfishing activity at the P. H. Robinson Generating Station discharge into Galveston Bay, Texas was taken from 21 October 1968 through 8 November 1969. During 108 daily checks, 1,063 fishermen were interviewed and 2,635 fish counted. Fishing activity was related to season and temperature of the heated effluent. Maximum fishing pressure and largest catches occurred during the period December 1968 through April 1969 and November 1969 when discharge water temperatures and flow rates were minimum. Lowest angling activity and catch rates were recorded from June through September 1969 when water temperatures approached 40 C in the upper part of the fishing area. Atlantic croaker, Micropogon undulatus; sea catfish (hardhead), Arius felis; sand seatrout, Cynoscion arenarius; black drum, Pogonias cromis; red drum, Sciaenops ocellata; and spot, Leiostomus xanthurus, in order of decreasing abundance, accounted for 96.7% of the fish counted during the study. Seine, trawl, and trammel net data taken from the outfall area indicated that creel survey data of fishing pressure and angling success were valid indicators of fish concentration. (Authors)

16775. Ritchie, Jerry C., J. Roger McHenry, and Angela C. Gill (USDA Sedimentation Lab., Oxford, Mississippi). 1973. DATING RECENT RESERVOIR SEDIMENTS. Limnol. & Oceanogr., 18(2): 254-263.

Radioactive fallout ^{137}Cs can be used to date sediment deposited in lakes and reservoirs since 1959. Within small regional watersheds, fallout ^{137}Cs is assumed to be uniformly distributed on the surface soil and is tightly adsorbed to surface soil particles. Some of these soil particles naturally labeled with ^{137}Cs then move through the sedimentation cycle and can be used to date sediment profiles. Two distinct periods of erosion and sedimentation (1959-1960 and 1963-1964) can be associated with periods of maximum atmospheric fallout. Data from other reservoirs illustrate the utility of this method. (Authors)

16776. Lutz, F. (Institut für Pharmakologie und Toxikologie im Fachbereich Veterinärmedizin der Justus Liebig-Universität, Giessen, Germany). 1973. ISOLATION AND SOME CHARACTERISTICS OF LIVER PLASMA MEMBRANES FROM RAINBOW TROUT. Comp. Biochem. Physiol., 45(4B): 805-811.

A method for the isolation of plasma membranes from the rainbow trout (Salmo gairdneri) is described. After homogenization in isotonic sucrose-Tris buffer at pH 7.4, followed by centrifugation at low speed, repeated homogenization and isopycnic centrifugation, the fraction with density 1.12-1.14 contained purified plasma membranes. The yield was 0.25 mg protein/g liver wet wt. The activities of the following enzymes were enriched in this fraction: $(Mg^{2+}\text{-}K^{+})$-ATPase, $(Na^{+}\text{-}K^{+})$-ATPase, neutral Mg^{2+}-p-nitrophenylphosphatase, K^{+}-p-nitrophenylphosphatase, nucleosidediphosphatase, 5'-nucleotidase, and nucleotide pyrophosphatase. NAD-nucleosidase observed in the plasma membranes was probably a real constituent of this fraction and not a contaminant. (Auth.)

16777. Lawler, Adrian R., and Willard A. Van Engel (Section of Parasitology, Gulf Coast Res. Lab., Ocean Springs, Mississippi 39564). 1973. CHANGE IN FEEDING AND BODY CONDITION OF BROWN BULLHEADS OVERWINTERING IN THE HEATED EFFLUENT OF A POWER PLANT. Chesapeake Science, 14(2): 138-145.

Winter food habits and condition factors of the brown bullhead, Ictalurus nebulosus, were determined from specimens collected in the discharge canal of the Connecticut Yankee Atomic Power Company plant and Chapman Pond, a cove of the Connecticut River unaffected by artificial heating. Stomach content analysis indicated that fish overwintering in the heated discharge fed while those in water at 2C from Chapman Pond did not. Fish, annelids, insects, molluscs and zooplankton were consumed, with fish the most abundant food. Bullheads began feeding before the temperature reached 4C in Chapman Pond. The normal bullhead diet of invertebrates shifted to smaller fish in the densely populated canal. Although the bullheads in the canal fed throughout the winter, their body condition was poorer than that of fish overwintering in Chapman Pond. (Authors)

16778. Persov, G. M. (Biol. Inst. of Leningrad State Univ., USSR). 1972. FUNCTIONAL LABILITY OF THE REPRODUCTIVE SYSTEM OF FISH. J. Ichthyol., 12(2): 226-240.

It is well known that the solution of biological problems may have many connotations. An attempt is made in this paper to show the application of this general proposition to the description of one of the most important facets of the biology of a population, its reproductive capacity. As is shown, the reliability of the functioning of the latter is determined inter alia, by such features as "emergency" reserves of gametes and the presence of "alternative means". Solution of the problem of the formation, expenditure and replenishment of the gametes is of great importance for a deeper understanding of these questions. The data obtained can be considered in a wider context, namely for the characterization of dynamic interaction between the conservatism and lability of the functioning of biological systems.

16779. van Arkel, M. A., W. Maasse, and A. Schuijf (Lab. of Comp. Physiol., Utrecht, The Netherlands). 1973. AN UNDERWATER FOOD DISPENSER FOR CONDITIONING FISH. Experientia, 29(5): 642-643.

16780. Schell, Stewart C. (Dept. of Biol. Sci., Univ. of Idaho, Moscow, Idaho). 1973. THE LIFE HISTORY OF Neopaleorchis catostomi gen. et sp. n. (TREMATODA: MONORCHIIDAE), AN INTESTINAL PARASITE OF THE COARSESCALE SUCKER, Catostomus macrocheilus Girard. J. Parasitol., 59(3): 463-468.

Embryonated eggs of Neopaleorchis catostomi are eaten by the operculate snail, Lithoglyphus virens (family Amnicolidae) in which the miracidium hatches and develops into a delicate, saccate sporocyst which produces a generation of rediae. The latter give rise to chaetomicrocercous cercariae which encyst in the gastropods Ferrissia rivularis, Gyraulus similaris, Physa ampullacea and the sphaeriid clams Pisidium variable and Musculium rykholti, as well as in non-infected L. virens. Metacercariae 50 to 60 days old were fed to young coarse-scale suckers, Catostomus macrocheilus, and partially developed worms were recovered 15 and 29 days later. (Auth.)

16781. Kaya, Calvin M. (Lab. of Limnol., Dept. of Zool., Univ. of Wisconsin, Madison, Wisconsin). 1973. EFFECTS OF TEMPERATURE ON RESPONSES OF THE GONADS OF GREEN SUNFISH (Lepomis cyanellus) TO TREATMENT WITH CARP PITUITARIES AND TESTOSTERONE PROPIONATE. J. Fish. Res. Bd. Canada, 30(7): 905-912.

Previous investigations have demonstrated that stimulation of gonadal recrudescence in the green sunfish (Lepomis cyanellus) depends on the concurrent presence of long photoperiods (15 hr) and elevated temperatures (>15 C). The present investigation indicates that recrudescence can be stimulated in seasonally regressed ovaries and testes by injections of a crude extract of fish pituitary glands, and in testes by testosterone propionate, but only under elevated temperature. The low temperatures that block gonadal responses to long photoperiods also effectively prevent gonadal responses to administered hormones. These observations indicate that the responsiveness of the gonads of this species to stimulating hormones is markedly modified by temperature; however, the results do not obviate the possibility that secretion of gonadotropins by the brain-pituitary system may also be affected. (Auth.)

16782. McCraren, Joseph P. (Warmwater Hatchery Biologist Center, Nat'l Fish Hatchery, Tishomingo, Oklahoma 73460). 1973. THE CHANNEL CATFISH VIRUS. Farm Pond Harvest, 7(1): 20-21.

In this magazine article concerning the channel catfish virus disease (CCV), several important aspects of its nature are discussed. Included is its similarity to viral diseases of young livestock, its transmission, characteristic symptoms, geographical range, forms of stress known to have precluded epizootics, and control measures. Photographs of CCV-affected specimens and a list of laboratories in catfish farming areas equipped to isolate and identify the virus are also included. (Auth.)

16783. Braber, L., and S. J. De Groot (Netherlands Inst. for Fish. Investig., IJmuiden, The Netherlands). 1973. THE FOOD OF FIVE FLATFISH SPECIES (PLEURONECTIFORMES) IN THE SOUTHERN NORTH SEA. Netherlands Journal of Sea Research, 6(1/2): 163-172.

The food composition of 5 commercially important flatfish species (Pleuronectiformes: turbot, brill, plaice, dab, sole) inhabiting the southern North Sea is given. During their growth there is a shift in food preference, whereby post-larval stages feed rather uniformly on meiofauna. The differences in preference between the investigated species is most outspoken when juveniles and adults are compared. (Authors' summ.)

16784. Plumb, J. A. 1973. Streptococcus sp. IN MARINE FISH. Newsl. SE Coop. Fish. Dis. Proj., 10: 2.

History, composition, and pathology involved in the fish-kill; and subsequent isolation and pathology of the causative agent are briefly discussed.

16785. Austin, Elizabeth R., and G. Fred Lee (Water Chem. Prog., Univ. of Wis., Madison, Wisconsin). 1973. NITROGEN RELEASE FROM LAKE SEDIMENTS. J. Wat. Poll. Contr. Fed., 45(5): 870-879.

A study was made of the release of nitrogen compounds from two Wisconsin lakes' sediments that were completely mixed with the water at all times. Under aerobic conditions, over 49 percent of the total nitrogen present in one sample was released as soluble organic nitrogen, ammonia, and nitrate in approximately 200 days. Under anaerobic conditions, these sediments released about 6 percent of the nitrogen in a similar period of time. Sediments from the second lake released 5 and 2 percent, respectively, of the potentially released nitrogen in 100 days under aerobic and anaerobic conditions. Similar tests conducted on unstirred sediments showed that the amount of mixing was probably one of the controlling factors of nitrogen release. (Authors)

16786. Fast, Arlo W., Brian Moss, and Robert G. Wetzel (Dept. of Fish. and Wildl., Mich. State Univ., East Lansing, Michigan). 1973. EFFECTS OF ARTIFICIAL AERATION ON THE CHEMISTRY AND ALGAE OF TWO MICHIGAN LAKES. Water Resources Research, 9(3): 624-647.

Two lakes were artificially aerated by using compressed air. Section Four Lake, an unproductive lake, was completely mixed, whereas Hemlock Lake, a eutrophic lake, had its hypolimnion aerated but thermal stratification maintained. Chemical and algal changes in Section Four Lake during destratification were not great. Although phytoplanktonic production potentials increased during mixing, the phytoplankton standing crop appeared to decline slightly, possibly due to the increased mixing depth and turbidity. Hemlock Lake hypolimnetic anoxia and conditions associated with it were eliminated during aeration. The lake gradually destratified during aeration due to leaks in the aeration tower. These leaks also released nutrient rich water into the epilimnion, which promoted algal growth. (Authors)

16787. Tyus, Harold M. (Environ. Resources Branch, U. S. Army Corps of Engineers, Wilmington, North Carolina). 1972. NOTE ON THE LIFE HISTORY OF THE ALEWIFE, Alosa pseudoharengus, IN NORTH CAROLINA. J. Elisha Mitchell Sci. Soc., 88(4): 240-243.

Young alewives (25 to 105 mm) were captured in Lake Mattamuskeet, North Carolina, in the winter month of January as well as in June and November, although their access to the marine habitat is not blocked. Sex ratios of adult fish entering the lake during spring spawning migrations were analyzed by chi square. A significant departure from the expected 1:1 male:female ratio occurred, with the males more numerous in spawning runs during the early part of the spawning season in 1970 and 1971. Females predominated during the last part of the spawning season in both years; however chi-square analysis indicated that a significant difference from 1:1 occurred during only one week in 1970. Measurements from adult fish captured by nonselective trapping devices indicated that males were smaller than females, and year-to-year differences in size range were small in the sampled population. (Auth.)

16788. Nozaki, Yukinori, and Shojiro Miyahara. 1972. RATIO OF STRONTIUM AND CALCIUM IN FISHES BY THE VARIATION OF COMPONENTS IN ENVIRONMENTAL WATER. Bull. Fac. Fish. Nagasaki, No. 34, pp. 69-73. In Japanese with English abstracts, tables and figs.

Some experiments were carried out with "Mejina" Girella punctata Grey to see whether or not the fish takes up strontium as the concentration of strontium and calcium in the environmental sea water is higher than that in the general sea water. After 40 days, the amount of strontium in the scale, skin, gill, muscle, digestive tract, liver and vertebra of the index fishes was larger than that in those organs of the fish living in general sea water, although the accumulation varied in degree by organ. The accumulation was especially dense in hard tissue such as scale, gill and vertebra compared with that in soft tissue. The accumulation of strontium in fish organs was related to the absolute concentration of strontium in the environmental water irrespective of the concentration of calcium in the water. (Authors)

16789. Whitt, Gregory S., William F. Childers, and Paula L. Cho (Dept. of Zool., Univ. of Illinois, Urbana, Illinois 61801). 1973. ALLELIC EXPRESSION AT ENZYME LOCI IN AN INTERTRIBAL HYBRID SUNFISH. Reprint from Journal of Heredity, 64(2): 55-61.

The genetic regulation of allelic isozymes in the differentiated tissues of F_1 intertribal hybrids (♂ green sunfish X ♀ largemouth bass) was analyzed by starch gel electrophoresis. Eight of the fourteen enzyme loci examined encode allelic forms of the enzymes with different electrophoretic mobilities. Both parental alleles at five of these loci are expressed equally in the F_1 hybrid. The expression of the maternal alleles for glucose 6-phosphate dehydrogenase and a liver esterase are repressed. Both alleles for a liver esterase locus and an eye esterase locus are not expressed. These observations of maternal allele repression instead of paternal allele repression necessitate new hypotheses concerning the mechanisms of allelic inhibition. In addition there is a correlation between the extent of allelic inhibition and the degree of genetic distance between the parental genomes in the F_1 hybrid. (Authors' summ.)

16790. Ware, D. M. (Inst. of Resource Ecol., Univ. of Brit. Columbia, Vancouver, British Columbia, Canada). 1973. RISK OF EPIBENTHIC PREY TO PREDATION BY RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(6): 787-797.

A model is developed to describe the risk of aquatic prey to visual predators in general, and is evaluated with particular reference to rainbow trout (Salmo gairdneri). The equation system uses several principles of visual mechanics to determine predation rates and therefore requires statistics on the physical properties of the food resource, besides the visual acuity and other searching constraints of the predator. Application of the model to an independent set of field data accounted for 47% of the seasonal variation in the occurrence of four benthic invertebrate prey in the diet of trout from Marion Lake, B. C. Considerably better agreement - 70% of the variation - was obtained using a three prey system. Sequential comparisons between the predicted and observed pattern of predation suggest that prey activity, prey exposure, prey density, and prey size are four of the major determinants of prey risk in benthic food chains. (Auth.)

16791. Takashima, Fumio, Takashi Hibiya, Phan-van Ngan, and Katsumi Aida (Lab. Fish Physiol., Fac. Agri., The Univ. Tokyo, Bunkyo-ku, Tokyo, Japan). 1972. ENDOCRINOLOGICAL STUDIES ON LIPID METABOLISM IN RAINBOW TROUT - II. EFFECTS OF SEX STEROIDS, THYROID POWDER AND ADRENOCORTICOTROPIN ON PLASMA LIPID CONTENT. Bull. Jap. Soc. Sci. Fish., 38(1): 43-49. In English.

In order to clarify the endocrine control over the egg yolk formation, the effects of estrogenic substance (diethylstilbestrol), androgenic substance (methyltestosterone), thyroid hormone (powdered mammalian throid gland), and adrenocorticotropin on plasma lipid and lipoprotein in rainbow trout were examined. Levels of total lipid and lipoprotein in plasma were raised by estrogen treatment. The liver of estrogen-treated fish was hypertrophic, and contained more lipid, protein and nucleic acids. It is concluded that the lipoprotein is synthesized in liver and released into the blood under the influence of ovarian steroid hormone. On the contrary, the levels of lipid and lipoprotein were reduced by thyroid powder administration. From these results it is suspected that an endocrine correlation mechanism affects the metabolism of lipoproteins that are deposited in the oocytes. (Authors)

16792. Hall, Ross W., Jr., and Dale W. Toetz (Dept. of Zool., Okla. State Univ., Stillwater, Oklahoma 74074). 1973. OBSERVATIONS ON THE NITROGEN FIXING POTENTIAL OF THE SURFACE WATERS OF A LARGE IMPOUNDMENT. The Southwestern Naturalist, 18(1): 93-114.

Information of comparative limnological interest is provided on the nitrogen fixing potential of the surface waters of Keystone Reservoir, Oklahoma, and the annual cycle there of phenomena, which can control the rate of N_2 fixation.

16793. Miller, Richard L., Andrew C. Olson, Jr., and Lee W. Miller. 1973. FISH PARASITES OCCURRING IN THIRTEEN SOUTHERN CALIFORNIA RESERVOIRS. Calif. Fish and Game, 59(3): 196-206.

Four hundred eighty fishes representing 13 freshwater species from 7 genera and 4 families were collected from 13 reservoirs and examined for metazoan parasites. Dorosoma petenense, Cyprinus carpio, Notemigonus crysoleucas, Ictalurus catus, I. melas, I. natalis, I. nebulosus, I. punctatus, Lepomis cyanellus, L. macrochirus, Micropterus salmoides, Pomoxis annularis, and P. nigromaculatus were infected with one or more helminths. Parasites found were Digenea: Hysteromorpha triloba, Posthodiplostomum minimum, Uvulifer ambloplitis, and Clinostomum marginatum; Monogenea: Dactylogyrus extensus, Cleidodiscus pricei, Urocleidus dispar, U. ferox, U. furcatus, U. principalis, and Actinocleidus fusiformis; Cestoda: Corallobothrium fimbriatum, C. giganteum, Proteocephalus ambloplitis, Proteocephalus sp., and Bothriocephalus claviceps; Nematoda: Contracaecum sp. and Eustrongylides sp.; Acanthocephala: Southwellina hispida; and Hirudinea: Myzobdella moorei. Of these twenty parasites, four are new records for California. This survey will provide some baseline data for fisheries management in San Diego County and southern California. (Auth.)

16794. Cooper, James L. (Montana Fish and Game Dept., Glasgow, Montana 59230). 1973. VERTICAL DISTRIBUTION PATTERNS OF GOLDEYE, Hiodon alosoides, IN FORT PECK RESERVOIR, MONTANA. NOAA Fishery Bulletin, 71(2): 473-478.

In November 1967 and continuing into December 1969, the goldeye, Hiodon alosoides (Rafinesque), in Fort Peck Reservoir, Mont., exhibited seasonal vertical distribution patterns, which seemed to be related to the surface-water temperature. When surface-water temperatures were above 8.9°C (summer and early fall), the goldeye congregated near the surface. During the late fall, ice-covered period, and spring when surface temperatures varied between 8.9° and 1.1°C, the goldeye usually congregated between the 8- and 32-ft level. However, it is the opinion of the author that the goldeye were following the food source and were not responding to temperature per se. (Auth.)

16795. Shaklee, James B., Kathryn L. Kepes, and Gregory S. Whitt (Dept. of Biol., Yale Univ., New Haven, Connecticut 06520). 1973. SPECIALIZED LACTATE DEHYDROGENASE ISOZYMES: THE MOLECULAR AND GENETIC BASIS FOR THE UNIQUE EYE AND LIVER LDHs OF TELEOST FISHES. J. Exp. Zool., 185(2): 217-240.

Electrophoretic and immunochemical analysis of the lactate dehydrogenase isozyme patterns of fishes indicates that these isozymes are the tetrameric products of three LDH loci - A, B, and C - which are present in virtually all teleost fishes. The A and B genes of fishes and their corresponding isozymes have previously been shown to be homologous to the A and B genes of other vertebrates. The eye-band LDH characteristic of many groups of teleosts, and the liver-band LDH of gadoid and cyprinid fishes are shown in this report to be encoded in the same LDH locus, designated C. In different groups of fishes this third LDH gene (C) is extremely varied both with regard to its tissue-specific regulation and with regard to the physical properties of its corresponding subunit. The electrophoretic mobility of the C_4 isozyme ranges from highly anodal in some species to slightly cathodal in others while the mobilities of the A_4 and B_4 tetramers remain relatively constant. Most fish species express the A and B genes for LDH in nearly all tissues. In contrast, the C gene is highly restricted in tissue expression in most advanced teleosts where its isozymic products are found predominantly in the eye of some species or in the liver of others. (Authors)

16796. Page, Lawrence M., and Gregory S. Whitt (Ill. Natural History Survey, Urbana, Illinois). 1973. LACTATE DEHYDROGENASE ISOZYMES OF DARTERS AND THE INCLUSIVENESS OF THE GENUS Percina. Illinois Natural History Survey, Biological Notes No. 82, 7 p., illus.

16797. Cech, Joseph J., Jr., and Donald E. Wohlschlag (Univ. of Texas, Marine Sci. Inst., Texas). 1973. RESPIRATORY RESPONSES OF THE STRIPED MULLET, Mugil cephalus (L.) TO HYPOXIC CONDITIONS. J. Fish Biol., 5(4): 421-428.

Ventilation volume, ventilatory frequency, ventilatory stroke volume, percentage utilization of oxygen and respiratory metabolism were measured on unanaesthetized striped mullet, Mugil cephalus L., under ambient and hypoxic conditions with a modified van Dam respiration chember. Hypoxia caused a statistically significant increase in ventilation volume, ventilatory frequency, and ventilatory stroke volume and a significant decrease in percentage utilization of oxygen. The routine rate of respiratory metabolism was not significantly altered by hypoxia. These responses probably represent ventilatory adjustments which serve to maintain a constant oxygen supply to the gills under conditions of oxygen depletion. (Authors)

16798. Gregory, L. A., and J. S. Loch. 1973. BENTHOS STUDIES (1971 AND 1972) ON THE WINNIPEG RIVER IN THE VICINITY OF THE ABITIBI MANITOBA PAPER COMPANY, PINE FALLS, MANITOBA. Environment Canada, Resource Mgmt Branch, Technical Report, Series No. CEN T-73-3, 30 p.

Benthic surveys were conducted in the summers of 1971 and 1972 to assess the condition of the Winnipeg River in the vicinity of the Abitibi Manitoba Paper Company's pulp mill at Pine Falls, Manitoba. Both qualitative and quantitative (genera diversity indices and information alalysis) analyses of the benthic data indicated that severe to moderate pollutant-effects prevailed at the mill's outfall and extended for up to four miles downstream. No change in the condition of the benthic community occurred between the summers of 1971 and 1972. (Authors)

16799. Guilbault, G. G., R. L. Lozes, W. Moore, and S. S. Kaun (Dept. of Chem., La. State Univ., New Orleans, Louisiana). 1972. EFFECT OF PESTICIDES ON CHOLINESTERASE FROM AQUATIC SPECIES: CRAYFISH, TROUT AND FIDDLER CRAB. Environ. Letters, 3(4): 235-245; Selected Water Resources Abstracts, 6(16): p. 72.

Purified cholinesterase enzymes were isolated in samples of trout, crayfish and fiddler crabs; nineteen pesticides were tested for inhibition of cholinesterase activity. Laboratory analyses show that trout cholinesterase is insensitive to all chlorinated and most organophosphorous pesticides. Crayfish have a high sensitivity to paraoxon and Mesurol and fiddler crabs are selectively inhibited by six pesticides. Overall, chlorinated pesticides seem to have little inhibitory effect on trout or crab cholinesterase; carbamates strongly inhibit all three enzymes. The experimental method of isolating the purified enzyme from each sampled species permitted a very sensitive and selective assay.

16800. Wheat, T. E., G. S. Whitt, and W. F. Childers (Dept. of Zool., Univ. of Ill., Urbana, Illinois 61801). 1973. LINKAGE RELATIONSHIPS OF SIX ENZYME LOCI IN INTERSPECIFIC SUNFISH HYBRIDS (GENUS Lepomis). Genetics, No. 74, pp. 343-350.

Backcross hybrids produced from the bluegill, the red-ear sunfish, and their F_1 interspecific hybrid have been analyzed for the inheritance of six enzyme phenotypes. Malate dehydrogenase A and B, tetrazolium oxidase, 6-phosphogluconate dehydrogenase, skeletal muscle esterase, and liver α-glycerophosphate dehydrogenase are all inherited in a mendelian manner as codominant alleles at nuclear loci. 6-phosphogluconate dehydrogenase and α-glycerophosphate dehydrogenase are encoded by linked loci, undergoing recombination at a frequency of 15%-22%. No other case of linkage was observed. The absence of linkage between the homologous malate dehydrogenase loci is of particular interest. These interspecific hybrids appear to be very useful for studies of biochemical genetics. (Authors)

16801. Kinney, Edward C. (Bur. of Sport Fish. & Wildl., U. S. Dept. of Interior, Washington, D. C.). 1973. AVERAGE OR MEAN pH. Prog. Fish-Cult., 35(2): p. 93.

16802. Gorbach, E. I. (Lab. of Freshwater Fish, Amur Dept. Pacific Res. Inst. for Sea Fish. & Oceanogr. (TINRO), Khabarovsk, USSR). 1972. FECUNDITY OF THE GRASS CARP [Ctenopharyngodon idella (Val.)] IN THE AMUR BASIN. J. Ichthyol., 12(4): 616-625.

Alterations in absolute and relative fecundity as a function of length, weight, age, condition, fatness and the availability of food are considered on the basis of material collected in the lower part of the Middle Amur in the years 1963-1969. An attempt is made to determine population fecundity.

16803. Olson, L. E., and L. L. Marking (Fish Control Lab., P. O. Box 862, La Crosse, Wisconsin 54601). 1973. TOXICITY OF TFM (LAMPRICIDE) TO SIX EARLY LIFE STAGES OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(8): 1047-1052.

The lampricide TFM (3-trifluoromethyl-4-nitrophenol) was tested against the following life stages of rainbow trout (Salmo gairdneri): green eggs, eyed eggs, sac fry, swim-up fry, fry, and fingerlings in four water hardnesses (12, 44, 170, and 320 mg/liter as $CaCO_3$). The eyed-egg stage was one of the most resistant stages tested, and the sac-fry stage was one of the least resistant. Increased water hardness decreases toxicity to all stages. The LC50's range from 0.532 mg/liter to 40.0 mg/liter depending upon life stage, water hardness, and duration of exposure. The margin of safety for coexisting species exposed to TFM ranges from 3.2 to 4.1 in natural waters. The margin of safety for early life stages of rainbow trout and larval lamprey under controlled laboratory conditions ranges from 4.2 to 12.2. Therefore, all six early life stages of rainbow trout are safe in minimum lampricidal concentrations of TFM. (Authors)

16804. Piper, Robert G., and Charlie E. Smith (Bur. Sport Fish. & Wildl., Fish Cultural Development Center, Bozeman, Montana 59715). 1973. FACTORS INFLUENCING FORMALIN TOXICITY IN TROUT. Prog. Fish-Cult., 35(2): 78-81.

Information provided by a questionnaire has helped to define more fully the extent of the problem of formalin toxicity in fish hatcheries. Of 74 hatcheries responding, 52 (70%) reported no formalin toxicity and 22 (30%) reported toxicity to fish at their station. The success of formalin in treating fish is dependent on its proper use. It should be diluted sufficiently before being added to the troughs or ponds to prevent areas of higher concentration. Rainbow trout (Salmo gairdneri) are the predominant problem species at 20 of the 22 hatcheries indicating formalin toxicity. Water chemistry had no correlation with incidence of formalin toxicity. Selected buffers tested at the Bozeman Center had no effect on formalin toxicity in rainbow trout. Four hatcheries reported a correlation between the strain of rainbow trout reared at their station and formalin toxicity. Three hatcheries indicated that water temperature was a factor, with mortality increasing as water temperatures increased. Two hatcheries reported that error in treatment caused excessive mortalities. One report showed that resistance in rainbow trout could be developed by exposing them regularly to formalin, while two workers indicated that pretreatment starvation can alleviate mortalities.

16805. Burnet, A. M. R. (Fish. Res. Div., Ministry of Agric. and Fish., Wellington, New Zealand). 1972. EFFECTS OF PARAQUAT ON INVERTEBRATES IN A CANTERBURY STREAM, NEW ZEALAND. N. Z. Journal of Marine and Freshwater Research, 6(4): 448-455.

During 1966 and 1967, paraquat was applied on three occasions at 2 ppm for 30 min to control aquatic weeds in the South Branch experimental stream, a tributary of the lower Waimakariri River, Canterbury, South Island, New Zealand. Effects on the invertebrate fauna of the stream were studied before, during, and after the applications, by Surber and drift-net samples. After a heavy initial kill, the paraquat treatment reduced the number of amphipods caught in the drift fauna to 5% of the pre-treatment level, and there was a slight reduction in the numbers of hemipterans. The total numbers in Surber samples increased markedly a year after treatments ended, mainly due to increased numbers of trichopterans. (Auth.)

16806. Priegel, Gordon R. 1973. LAKE STURGEON MANAGEMENT ON THE MENOMINEE RIVER. Wisconsin Dept. of Natural Resources Technical Bulletin No. 67, 20 p.

The Menominee River, a border stream between Wisconsin and Michigan, contains one of the last fishable lake sturgeon populations in Wisconsin and Michigan. A section between the White Rapids and Grand Rapids dams, 26 river miles, was intensively studied in 1969 and 1970 to determine the population present and the rate of exploitation. A randomly designed creel census schedule was employed. The population estimate based on the mark and recapture method employing four A.C. boom shockers as a means of capture was 234 and 185 legal-sized fish (42 inches and larger) in 1969 and 1970, respectively. The calculated fishing pressure was 14,300 hours in 1969 and 11,400 hours in 1970. Weekend angler counts were significantly larger than weekday counts and September counts were larger than October counts in 1969 and 1970. The estimated exploitation rate based on the anglers' harvest data was 13 percent in 1969 and 17 percent in 1970, which is considered too high. To maintain a harvestable population, an exploitation rate of 5 percent would be desirable. Wisconsin residents accounted for 78 percent of the fishing effort in both years. The fish ranged in age from 1 to 45 years and the age data indicated that there is natural reproduction occurring every year although varying in degree of success. Legal-sized fish (42 inches) began to enter the fishery at age 12. Surveys in other sections of the Menominee River in 1971 and 1972 indicated that if there is a lake sturgeon population above the White Rapids dam it is only nominal as no fish were captured. Lake sturgeon were taken from the White Rapids dam downstream to the mouth of the Menominee River, a distance of 50 river miles. (Auth.)

16807. Westöö, Gunnel (Food Lab., Nat'l Swedish Food Admn., S-104 01 Stockholm 60, Sweden). 1973. METHYLMERCURY AS PERCENTAGE OF TOTAL MERCURY IN FLESH AND VISCERA OF SALMON AND SEA TROUT OF VARIOUS AGES. Science, 181(4099): 567-568.

The proportion of methylmercury to total mercury in the flesh of salmon (Salmo salar) 1 to 7 years old and sea trout (Salmo ocla) 1 and 2 years old was found to average 93 percent with a range of 81 to 98 percent, and to be independent of the age of the fish. In salmon and sea trout 1 and 2 years old, methylmercury constituted 26 to 67 percent of the total visceral mercury, without age dependence. (Auth.)

16808. Aass, Per (Ministry of Agric., 1432 As-NLH, Norway). 1972. AGE DETERMINATION AND YEAR-CLASS FLUCTUATIONS OF CISCO, Coregonus albula L., IN THE MJØSA HYDROELECTRIC RESERVOIR, NORWAY. Inst. of Freshwater Research, Drottningholm, Report No. 52, pp. 5-22.

The reliability of cisco ageing techniques was tested by examining scales and otoliths from 2,068 fish caught on the spawning run during the years 1966-71. Disagreements between scale and otolith ages occur at all age levels, but increase markedly beyond otolith age 3+. In nearly all cases of disagreement otolith age is higher than scale age and the difference may be as great as seven years. Age compositions and length-frequency distributions together with tagging results demonstrate that cisco ages can be determined more accurately from otoliths than from scales. Otoliths show that most ciscoes mature at an age of 2+. Fish up to ages 7+-8+ are important for the commercial fishery. The oldest specimens identified were of the age 12+. The recruitment is very uneven. Only every third year does a rich year class arise. The intervening year classes are quite insignificant and may fail altogether to appear in the catches. The fluctuations are probably not caused by river regulations or lake impoundments, nor by climatic factors. It is suggested that intraspecific food competition is responsible for the population fluctuations. At the present time there is no need for fishery regulations or artificially stocking of cisco in Mjøsa. (Auth. summ.)

16809. Indo-Pacific Fisheries Council, and FAO of the UN. 1972. COASTAL AQUACULTURE IN THE INDO-PACIFIC REGION. Papers presented at the Indo-Pacific Fish. Council Symposium on Coastal Aquaculture, Bangkok, Thailand, 18-31 November 1970, 497 p., price £ 8.00, edited by T. V. R. Pillay.

16810. Halver, John E. (Fish Nutrition Lab., Bur. of Sport Fish. & Wildl., Cook, Washington). 1972. THE ROLE OF ASCORBIC ACID IN FISH DISEASE AND TISSUE REPAIR. Bull. Jap. Soc. Sci. Fish., 38(1): 79-88. in English.

Trout, salmon and several other kinds of fish require L-ascorbic acid in the diet. Deficiency symptoms include fracture dislocation of spine, lordosis, scoliosis, bizarre distortion of support cartilage and impaired collagen formation throughout the body. Rate of repair of inflicted wounds is directly dependent upon dietary ascorbic acid intake. Tissue levels of ascorbate reflect vitamin C dietary history. Fecal, branchial and urinary metabolites show rapid metabolism of ascorbate. One major urinary metabolite co-chromatographs in several systems identical with ascorbate-3-sulfate. L-Ascorbic acid is rapidly fixed in fish tissues wherever collagen is being formed.

16811. Colby, Peter J., and L. T. Brooke (Great Lakes Fish. Lab., U.S. Fish and Wildl. Service, Ann Arbor, Michigan 48107). 1973. EFFECTS OF TEMPERATURE ON EMBRYONIC DEVELOPMENT OF LAKE HERRING (Coregonus artedii). J. Fish. Res. Bd. Canada, 30(6): 799-810.

Embryonic development of lake herring (Coregonus artedii) was observed in the laboratory at 13 constant temperatures from 0.0 to 12.1 C and in Pickerel Lake (Washtenaw County, Michigan) at natural temperature regimes. Rate of development during incubation was based on progression of the embryos through 20 identifiable stages. An equation was derived to predict development stage at constant temperatures, on the general assumption that development stage ($\widehat{DS}$) is a function of time (days, D) and temperature (T). The equation should also be useful in interpreting estimates from future regressions that include other environmental variables that affect egg development. A second regression model, derived primarily for fluctuating temperatures, related development rate for stage j ($\widehat{DR}_j$), expressed as the reciprocal of time, to temperature (x). The generalized equation for a development stage is: $\widehat{DR}_j = ab^x c^{x^2} d^{x^3}$. In general, time required for embryos to reach each stage of development in Pickerel Lake agreed closely with the time predicted from this equation, derived from our laboratory observations. Hatching time was predicted within 1 day in 1969 and within 2 days in 1970. We used the equations derived with the second model to predict the effect of the super-imposition of temperature increases of 1 and 2 C on the measured temperatures in Pickerel Lake. Conceivably, hatching dates could be affected sufficiently to jeopardize the first feeding of lake herring through loss of harmony between hatching date and seasonal food availability. (Authors)

16812. Loch, J. S., and J. C. MacLeod (Resource Mgmt Branch, Fish. Operations Directorate, Central Region, Winnipeg, Canada). 1973. FISH TOXICITY SURVEY OF FOUR PRAIRIE PROVINCE PULP MILL EFFLUENTS. Environ. Canada, Technical Report Series No. CEN T-73-4, 14 p.

The acute toxicity to fish of four prairie pulp mill effluents was determined as part of a larger project conducted to obtain information on bioassay procedures and revised toxicity limits for pulp and paper mill effluent regulations. Only one mill (Prince Albert Pulp Co.) met the present regulatory requirements of a minimum of 80% survival of rainbow trout in 65% effluent under flow-through bioassay conditions. Three other mills (North West Pulp and Power, Churchill Forest Industries and Abitibi Manitoba Paper Company) did not meet the present requirements. (Authors)

16813. Montesano, R., A. J. Ingram, and P. N. Magee (Centre Internat. de Rech. sur le Cancer (WHO), Lyon, France). 1973. METABOLISM OF DIMETHYLNITROSAMINE BY AMPHIBIANS AND FISH IN VITRO. Experientia, 29(5): 599-601. In English with French Résumé.

The metabolism of (C^{14})-DMN has been examined by means of liver sections of trout, goldfish and three species of amphibians, as well as excretion of the carcinogen after intraperitoneal injection into the newt and the goldfish. The relation between the metabolism and the toxic and/or carcinogenic activity is discussed. (Authors' résumé).

16814. Lux, Fred E. (Northeast Fish. Center, NMFS, NOAA, Woods Hole, Massachusetts 02543). 1973. AGE AND GROWTH OF THE WINTER FLOUNDER, Pseudopleuronectes americanus, ON GEORGES BANK. NOAA Fish. Bull., 71(2): 505-512.

Lengths calculated at each scale annulus from 510 winter flounder, Pseudopleuronectes americanus, collected on Georges Bank during 1963-66 provided a measure of growth up to 12 years of age. Growth was more rapid on Georges Bank than on inshore areas. Females grew faster than males after age 2. Fish from eastern Georges Bank grew slightly faster than those from western Georges Bank. Bertalanffy growth equations were computed for each sex. (Auth.)

16815. Schwartz, Frank J. (Inst. of Mar. Sci., Univ. of N. C., Morehead City, North Carolina). 1972. RECENT OCCURRENCES OF CUBERA SNAPPERS (PISCES, LUTJANIDAE) IN NORTH CAROLINA ATLANTIC OCEAN WATERS. J. Elisha Mitchell Sci. Soc., 88(4): 252-254.

Four Lutjanus cyanopterus, ranging from 16.7 to 43.7 kg and to 1418 mm total length, were captured in Atlantic Ocean waters from near Cape Lookout to Wrightsville, North Carolina, in 1970 and 1971. Meristic and morphometric proportions were compared. Comments concern capture, transport to the area, and species distinctness. (Auth.)

16816. Nicholson, Bruce L., and Charles Byrne (Dept. of Microbiol., Univ. of Maine, Orono, Maine 04473). 1973. AN ESTABLISHED CELL LINE FROM THE ATLANTIC SALMON (Salmo salar). J. Fish. Res. Bd. Canada, 30(7): 913-916.

A monolayer culture of fibroblast-like cells was initiated from a trypsin digest of heart, liver, kidney, and spleen tissue of young Atlantic salmon (Salmo salar). This culture has been subcultured 81 times over a period of 21 months and appears to be an established cell line, which we have designated AS. Cells of the AS line multiply over a temperature range of 4-28 C with an optimum growth temperature of 20 C. Temperatures in excess of 29 C cause rapid cell death. The AS cells remain viable for periods up to 6 months at 4 C. An absolute plating efficiency of 30% has been determined for AS cells at 20 C. Analysis of the cell cycle of AS cells reveals a generation time (G_t) of 19.5 hr. The duration of the DNA synthetic period (S) is 10.5 hr, while the G_1 and G_2 periods are 1.1 and 7.1 hr, respectively. The duration of mitosis (M) has been calculated to be 0.9 hr with a mitotic index (M.I.) for the culture of 3.3%. Preliminary studies indicate a modal chromosome number of 54. The AS cell line is susceptible to infectious pancreatic necrosis (IPN) virus, infectious hematopoietic necrosis (IHN) virus and the myxovirus of bluegills. (Authors)

16817. Wydoski, Richard S., and Donald E. Bennett. 1973. CONTRIBUTIONS TO THE LIFE HISTORY OF THE SILVER SURFPERCH (Hyperprosopon ellipticum) FROM THE OREGON COAST. Calif. Fish and Game, 59(3): 178-190.

The silver and redtail surfperches are the most common fish inhabiting the surf zone of northern California and Oregon. Data on the life history of the silver surfperch from the Oregon coast were collected between June 1967 and January 1969. This paper provides the first published information on the biology of this species and includes summaries of age and growth by sex, length-weight relationships, relation between age and size to sexual maturity, fecundity, and a parasite that is unique to surf-dwelling embiotocids. Females grow faster than males and this characteristic was related to reproductive maturity. Silver surfperch first become sexually mature in Age Group I. Males are ripe in late September when copulation occurs. Females give birth to their young between late June and early August. Fecundity of the females was related to their size with the smallest (174 mm TL) containing 4 embryos and the largest (221 mm TL) containing 17. The incidence of a mono-genetic trematode (Dicliodophora sp.) that is found only on the gills of surf-dwelling embiotocids is summarized by age and size of the fish.

16818. Rawson, Mac V., Jr. (Ga. Coop. Fish. Unit, Univ. of Ga., Athens, Georgia). 1973. TWO NEW SPECIES OF Gyrodactylus (TREMATODA: MONOGENEA) FROM THE GEORGIA COAST. Proc. Helm. Soc. Wash., 40(2): 180-183.

16819. Smith, Albert C., and Harold B. Clemens (Marine Resources Region, Calif. Dept. of Fish and Game, Long Beach, California 90802). 1973. A POPULATION STUDY BY PROTEINS FROM THE NUCLEUS OF BLUEFIN TUNA EYE LENS. Trans. Amer. Fish. Soc., 102(3): 578-583.

Soluble proteins from the eye lens nucleus of bluefin tuna, Thunnus thynnus, were studied by electrophoresis. Polymorphism in proteins that migrated toward cathodal and anodal portions of the electrophoregrams is attributed to simple and complex genetic bases, respectively. Results suggest that bluefin in the California fishery belong to a single population which exhibits local genetic differentiation on the fishing grounds. (Authors)

16820. Eipper, Alfred W. (N. Y. Coop. Fish. Unit, Cornell Univ., Ithaca, New York 14850). 1973. IMPLICATIONS OF A CHANGING ENVIRONMENT TO THE TRAINING OF FISHERY BIOLOGISTS. Northeast Fish & Wildl. Conf, May 14-17, 1972 at Ellenville, New York, pp. 158-161.

Trends in human population numbers, aggregations and life styles, with their associated environmental impacts and resource allocation problems, pose important new problems for fishery biologists. Colleges and universities that train students for dealing with such problems must now produce more different kinds of fishery biologists, including many with both skills and inclinations for working closely with people of other disciplines on integrated management plans for sizeable ecological units. Accordingly, colleges should offer more diverse course and program options, and encourage students to narrow down as slowly and symetrically as possible during their undergraduate years. The undergraduate program should include core courses in the biology and the population ecology of fishes, and a fishery management course that includes coverage of the economic, legal, political and policy aspects. Probably few students have time to specialize in a particular area of fishery biology before graduate school. (Auth.)

16821. Tugarina, P. Ya (The A. A. Zhdanov Univ., Irkutsk, USSR). 1972. THE SYSTEMATIC POSITION OF THE GRAYLING (GENUS Thymallus) OF THE KAMCHATKA RIVER BASIN. J. Ichthyol., 12(3): 407-418.

Full data are given for the first time on the morphological and systematic characteristics of the grayling of the Kamchatka River Basin. It is compared with other subspecies of the genus Thymallus inhabiting bodies of water in northeastern and central Asia. The morphological and ecological differences which are noted enable us to suggest that this grayling is of subspecific status - Thymallus arcticus mertensi Val.

16822. Niehuss, M., and H. Borner (Inst. Phytopath., Christian-Albrechts Univ., Kiel, West Germany). 1971. STUDIES ON THE EFFECT OF HERBICIDES ON FISH. Nachrichtenblatt des Deutschen Pflanzenschutzdienstes (Braunschweig), 23(8): 113-117; Weed Abstracts, 21(6): abstract 3231.

TLm values (median tolerance limit causing mortality in 50% of the treated population in a given period of time) are given for guppy (Lebistes reticulatus) exposed under laboratory conditions to various concentrations of aminotriazole, dalapon, diuron, dichlobenil and paraquat. Toxic symptoms caused by high concentrations of the herbicides are described though all compounds showed a wide margin of safety at normal concentrations.

16823. Hocutt, Charles H., Patrick S. Hambrick, and Michael T. Masnik. 1973. ROTENONE METHODS IN A LARGE RIVER SYSTEM. Archiv für Hydrobiologie, 72(2): 245-252.

The use of rotenone, block net, and potassium permanganate proved to be an effective method for sampling fishes in a large river system. Methods developed were responsible for establishing nine distributional records of fishes in the main-channel New River, including the addition of three species (Cottus b. bairdi, Etheostoma caeruleum and Etheostoma osburni) to the known fauna. Rotenone resulted in higher numbers of species and specimens collected per locality than by seining. Analyses of the data revealed consistently higher diversity indexes (SUMD) for rotenone collections. (Authors)

16824. Hatai, Kishio, Takashi Aoki, and Tsutomu Watanabe (Product Development Lab., Sankyo Co., Tokyo, Japan). 1973. STUDIES ON MENOMYCIN (FLAVOPHOSPHOLIPOL) - I. MINIMAL INHIBITORY CONCENTRATIONS FOR VARIOUS FISH PATHOGENIC-BACTERIA AND THE EFFECTS FOR R$^-$ AND R$^+$ STRAINS ISOLATED FROM CULTURED FISHES. Fish Pathology, 7(2): 103-108; Fish Health News, 2(3): p. 7.

Minimal inhibitory concentrations (MIC) of Menomycin (so called Flavophospholipol) for various fish-pathogenic bacteria isolated from different cultured fishes in Japan and effects of Menomycin for R factors of gram negative-bacilli isolated from the cultured fishes were examined in vitro. MIC levels of Menomycin for various fish-pathogenic bacteria except Chondrococcus columnaris were within a range from 0.2 to 3.1 μg/ml. MIC level for C. columnaris was 50.0 μg/ml. Especially the MIC levels of Menomycin for Vibrio anguillarum and the pathogenic agent of bacteria-tuberculoidosis (Pasteurella piscicida) were almost the same as the levels of Chloramphenical, Thiamphenical and Chlortetracycline or showed a little stronger. MIC levels of Menomycin for the R$^-$ and R$^+$ strains of Aeromonas liquefaciens 67-P-24 were examined. Eleven strains of gram negative-bacilli carrying R factors isolated from intestines of cultured eels (Anguilla japonica) were used as donors and Escherchia coli CSH-2 as the recipient. The R factors transferred to E. coli CSH-2 were then each transferred to a R$^-$ strain, Aeromonas liquefaciens 67-P-24. MIC level of Menomycin for the R$^-$ strain was 3.1 μg/ml, while those for R$^+$ strains were all 1.6 μg/ml. This suggested that Menomycin has a stronger anti-bacterial effect for drug resistant bacteria carrying R factors than for bacteria not carrying it. A comparative study of the growth curves of R$^-$ and R$^+$ strains of Aeromonas liquefaciens incubated at 30° C in Penassay broth (Difco) containing various amounts of Menomycin revealed that anti-bacterial effect of Menomycin is stronger against the R$^+$ strain than the R$^-$ strain. (Authors' summ.)

16825. Tubiash, Haskell S., and Jerry D. Hendricks (U. S. Dept. of Comm., NOAA, Middle Atlantic Coastal Fish Center, Pathobiol. Investigations, Oxford, Maryland 21654). 1973. A POSSIBLE LIPOMA IN THE WEAKFISH, Cynoscion regalis (Bloch & Schneider). Chesapeake Science, 14(2): 145-146.

A subcutaneous growth, measuring 2.0 x 1.5 x 0.5 cm, was found attached by its anterior surface to the lower left abdominal musculature of a 32 cm weakfish. The gross appearance of this growth left no doubt that it was an abnormal mass of tissue. However, the abnormal character of the tissue was less apparent histologically, making a positive classification difficult. Neither the skeletal muscle nor the predominant adipose tissue cells were atypical, so if the mass was neoplastic, it was most probably an early growth stage of a particularly well differentiated lipoma.

16826. Eaton, Stephen W., and Larry P. Kardos. 1973. MYSIS AND SOME OTHER LARGE INVERTEBRATES OF CANANDAIGUA LAKE, 1972. Science Studies, St. Bonaventure Univ., Vol. 29, 15 p.

We took 28 horizontal trawls using a 0.5 meter diameter tow net at several depths at varying light intensities and caught approximately 19,000 Mysis which we measured and placed in small, medium, large male and large female categories. Two series of trawls in August and one series in October averaged 1.95/m^3, 3.18/m^3, and 3.86/m^3. Mysis was found at considerable distances off bottom during daylight and their breeding season extended from August to May. Gravid females averaged 18 mm in length and carried an average of 12 eggs or larvae in the marsupium. Notes on other larger planktonic invertebrates are included. (Authors)

16827. Dorfman, Donald (Monmouth College, New Jersey). 1973. SERUM PROTEIN PATTERNS OF WHITE PERCH. N. Y. Fish and Game Journal, 20(1): 62-67.

Eight serum protein fractions were discerned for white perch. Protein fraction percentages differed by geographic area and size of fish, as well as because of stress. Total proteins and hematocrits did not differ significantly in fish sacrificed in the field. Laboratory fish had reduced hematocrits. (Auth.)

16828. Hamley, John M., and Henry A. Regier (Dept. of Zool., Univ. of Toronto, Toronto 5, Ontario, Canada). 1973. DIRECT ESTIMATES OF GILLNET SELECTIVITY TO WALLEYE (Stizostedion vitreum vitreum). J. Fish. Res. Bd. Canada, 30(6): 817-830.

The selectivity of gillnets is usually estimated "indirectly" from comparisons of catches by two or more mesh sizes, assuming that the selectivity curves for all meshes have the same shape and amplitude. We estimated selectivity "directly" by fishing marked walleye (Stizostedion vitreum vitreum) with gillnets of 1-1/2 - 4-1/2 inch (3.81-11.43-cm) mesh. The selectivity curves were bimodal but each could be resolved into two unimodal components representing fish caught by wedging and tangling, respectively. We fitted the selectivity of each mesh to a pair of Pearson's Type I curves. As the mesh size increased, amplitude of the selectivity curves increased rapidly and tangling occurred over a progressively narrower range of (fish girth)/(mesh perimeter) ratio. Our estimates agreed with data from four out of seven other gillnetting studies, indicating a wider applicability but also a need to consider additional variables or to standardize fishing methods. Because the assumption of equal amplitudes is not realistic, the indirect methods overestimate selectivity curves on the left and underestimate them on the right. (Authors)

16829. Wong, B., and T. Whillans. 1973. LIMNOLOGICAL AND BIOLOGICAL SURVEY OF HOTTAH LAKE, NORTHWEST TERRITORIES. Environment Canada, Technical Report Series No. CEN T-73-6, 69 p.

A biological and limnological survey was conducted in Hottah Lake during the summer of 1972. The lake lies on the boundary of the Canadian Shield and is divided into two physiographic regions. The water area of the lake is 984.4 Km^2 with a mean depth of 18.9 m. No stable thermocline was observed in 1972. The lake water is noticeably uniform, being low in dissolved minerals. The bottom dissolved oxygen content remains near saturation throughout the summer. The lake is unproductive with low standing crops of plankton, benthos and fish. Lake whitefish and lake trout are the main fish species making up 94% of the catch by weight. It appears that past commercial fisheries have altered the population of fish in the lake. A revision of the present quota may be essential in the management of Hottah Lake. (Authors)

16830. McCraren, Joseph P., and Roy M. Jones (Warm Water Hatchery Biologist Center, Nat'l Fish Hatchery, Tishomingo, Olkahoma 73460). 1973. EVALUATION OF A NEW SPAWNING MAT MATERIAL. Prog. Fish-Cult., 35(2): p. 81.

Spawning mats for fantail goldfish were constructed using newly developed nylon bristle brushes. The mats required less maintenance and were more durable and easily handled than the widely-used moss mat. No preference between mat types was displayed by spawning goldfish. (Authors)

16831. Sano, Tokuo. 1972. STUDIES ON VIRAL DISEASES OF JAPANESE FISHES - III. INFECTIOUS PANCREATIC NECROSIS OF RAINBOW TROUT: GEOGRAPHICAL AND SEASONAL DISTRIBUTIONS IN JAPAN. Bull Jap. Soc. Sci. Fish., 38(4): 313-316. In English.

Rainbow trout fry from 27 hatcheries and culture farms located in the prefectures of Shizuoka, Nagano, Yamanashi, Tokushima, Shimane, and Tokyo were examined virologically for virus infestations. The virus, isolated from 24 of the samples and titers, ranged from $10^{5.8}$ to $10^{8.2}$ $TCID_{50}$ per ml. In the three additional prefectures, Tokushima, Shimane, and Tokyo, the virus was isolated for the first time. Virus was isolated in both spring and summer fry and from these facts it can be concluded that the virus is widespread in Japan and epizootics occur regardless of season. (Auth.)

16832. De Roth, Gerardus C. (Dept. of Nat. Systems, Defiance College, Defiance, Ohio). 1973. EFFECTS OF TEMPERATURE AND LIGHT ON AERIAL BREATHING BEHAVIOR OF THE SPOTTED GAR, Lepisosteus oculatus. The Ohio Journal of Science, 73(1): 34-41.

16833. Fagerström, Åke. 1972. NETTING FOR BETTER ANGLING IN A SMALL MOUNTAIN LAKE. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 38-49.

Angling in a small mountain lake close to the Norwegian border was registered during the period 1948-1971. A discouraging trend in the average size of brown trout gave the impetus to a management experiment to reduce the fish density. The heaviest reduction was of arctic char, 75 percent of the adult population of which was removed in 1966. Brown trout, too, was netted and seined. Growth data and year-class analysis indicate that the overall effect on the fish population was slight. Some growth-rate improvement appeared in char and trout. The year classes were influenced by spring climate to the same extent as by exploitation by man of the number of spawners. The fears of the average angler that the gill nets would ruin the angling possibilities were not fulfilled. The trend of a declining yield in angling was broken and in 1971 the average weight of brown trout was the highest on record. The same was true of the number of arctic char caught with the fly. (Auth. summ.)

16834. Peterson, R. H. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1973. TEMPERATURE SELECTION OF ATLANTIC SALMON (Salmo salar) AND BROOK TROUT (Salvelinus fontinalis) AS INFLUENCED BY VARIOUS CHLORINATED HYDROCARBONS. J. Fish. Res. Bd. Canada, 30(8): 1091-1097.

The effects of previous exposure to p, p'-DDT, o, p'-DDT, p, p'-DDD, p, p'-DDE, and methoxychlor on temperature selection by juvenile Atlantic salmon (Salmo salar) in a horizontal temperature gradient were similar. Exposure to low concentrations resulted in no change or a decrease in selected temperatures as compared to control values of about 16 C. Exposure to higher concentrations raised selected temperatures. The concentrations of the substances required to produce a given effect varied as: p, p'-DDT $\geq$ p, p'-DDD $>$ methoxychlor $>$ o, p'-DDT $>$ p, p'-DDE. Exposure levels of p, p'-DDA $\leq$ 8 ppm did not alter temperature selection nor did exposure to Aroclor 1254, a polychlorinated biphenyl (PCB) preparation at 2 ppm. Aldrin lowered temperature selection at 0.1-0.15 ppm. In a vertical gradient, brook trout (Salvelinus fontinalis) previously exposed to p, p'-DDT and p, p'-DDD selected higher temperatures than controls. (Auth.)

16835. Everett, G. V. (Universidad Tecnica del Altiplano, Puno, Peru). 1973. THE RAINBOW TROUT Salmo gairdneri (Rich.) FISHERY OF LAKE TITICACA. J. Fish Biol., 5(4): 429-440.

Rainbow trout were introduced to Lake Titicaca in 1942. A commercial trout canning operation started in 1961 but terminated in 1970. Data for this study were collected in 1966 and 1967, with the object of examining the life history, biology, and commercial fishery of Titicaca rainbow trout. Trout were caught commercially and experimentally by gillnets in different parts of the lake. Lake Titicaca lies across the border of Peru and Bolivia at 3212 m above sea level. The physicochemical characteristics of the lake appear ideal for self-sustaining populations of rainbow trout. Growth was constant throughout the year, and was good in relation to growth rates of rainbow trout in other parts of the world. Spawning took place in the tributaries in the winter. Recruitment to the fishery occurs in 7.62 cm stretch mesh gillnets at about 27 cm fork length. The total annual commercial catch increased to 500 metric tons in 1965 before subsequently decreasing. The simplest explanation for the decline in total catch would be the increase in fishing mortality due to increased fishing effort, although it is possible that the decline in water level has had some effect. It appeared possible that the lake could sustain an annual catch of about 350 tons. (Auth.)

16836. Biggins, Richard, and Scott Cressey (Vermont Fish and Game Dept., Roxbury, Vermont 05669). 1973. A TECHNIQUE FOR CAPTURING TROUT WITH GILL NETS IN DEEP STREAMS. Prog. Fish-Cult., 35(2): p. 106.

16837. Wedemeyer, Gary (Bur. of Sport Fish. & Wildl., Western Fish Disease Lab., Sand Point Naval Support Activity, Seattle, Washington 98115). 1973. SOME PHYSIOLOGICAL ASPECTS OF SUBLETHAL HEAT STRESS IN THE JUVENILE STEELHEAD TROUT (Salmo gairdneri) AND COHO SALMON (Oncorhynchus kisutch). J. Fish. Res. Bd. Canada, 30(6): 831-834.

A rapid (3 min) but sublethal temperature increase from 10 to 20 imposed a greater stress on juvenile coho salmon (Oncorhynchus kisutch) than on juvenile steelhead trout (Salmo gairdneri). Both species suffered hyperglycemia, hypocholesterolemia, increased blood hemoglobin, and decreased blood sugar regulatory precision, but the steelhead recovered more quickly. Acid-base equilibrium was essentially unaffected, and only the coho suffered any significant interrenal vitamin C depletion. Vitamin C normalization required about 24 hr. (Auth.)

16838. Reisman, Howard H., and William Nicol (Div. of Nat. Sci., Southampton College, New York). 1973. THE FISHES OF GARDINER'S ISLAND, NEW YORK. N. Y. Fish and Game Journal, 20(1): 25-31.

Gardiner's Island is a privately owned island whose ichthyofauna had not previously been surveyed by any agency. Furthermore, it includes a series of ponds which provide an opportunity for distinctly different fish populations to become established. This paper presents information concerning the fishes present and their distribution, together with data on the characteristics of the ponds. (Authors)

16839. Lander, Robert H. (Northwest Fish. Center, NMFS, NOAA, 2725 Montlake Blvd East, Seattle, Washington 98112). 1973. PROBLEM OF BIAS IN MODELS TO APPROXIMATE OCEAN MORTALITY, MATURITY, AND ABUNDANCE SCHEDULES OF SALMON FROM KNOWN SMOLTS AND RETURNS. NOAA Fishery Bull., 71(2): 513-525.

The problem of methodological bias in estimating ocean mortality or survival, maturity, and abundance of multireturn species of Pacific salmon (Oncorhynchus spp.) is examined heuristically with a data base for which no unbiased estimators exist. The case of hatchery coho salmon (O. kisutch) is emphasized to treat the problem in its simplest form (two returns). Models previously reported by Ricker, Fredin, and Cleaver are considered in the context of their application in biomass computations and the particular problem of bias in approximating average and interval-specific mortality coefficients during ocean life. A new scheme is introduced as the limit-mean model, and the assumptions in all four models are contrasted. Numerical examples for a hypothetical cohort demonstrate a wide range of bias in estimates of different parameters from the same model and also in estimates of the same parameter from different models applied in different situations. For the hypothetical data, overall performance is best for the limit-mean model with the offshore catch known; this model also provides estimates of natural and fishing mortality rates offshore during the last year at sea. For coho and chinook salmon, (O. tshawytscha) caught off western North America, it is recommended that 1) maturity be directly sampled to help provide nominally unbiased estimates for certain of the parameters and 2) research be intensified on determining offshore catch by origin independently of marking smolts. (Auth.)

16840. Avanesov, E. M. (Azerbaydzhanian Dept., Central Sturgeon Fish. Res. Inst., USSR). 1972. PRESENT SPAWNING CONDITIONS OF MULLETS (GENUS Mugil) IN THE CASPIAN SEA. J. Ichthyol., 12(3): 419-425.

The spawning of mullets was observed in the Caspian in the period 1968-1970. It was established that spawning of the grey mullet occurs in a wide area of the sea, beginning in the southern part of the Caspian Sea at the end of May - beginning of June and extending in July to northern areas of the middle Caspian. The most intensive spawning was recorded in the Turkmenian waters of the south Caspian in August at a temperature of 25 - 29°C 5 - 7 miles from the shore where depth was 5 - 40 m. Spawning of the long-finned mullet begins in the middle of July - beginning of August in the middle Caspian and then extends in range until October, to include the south Caspian. Intensive spawning of this mullet species was noted at a temperature of 20 - 22°C some considerable distance from the shore where depths were 400 - 600 m.

16841. Hinshaw, Russell N. (Utah State Div. Wildl. Resources, Salt Lake City, Utah). 1973. POLLUTION AS A RESULT OF FISH CULTURAL ACTIVITIES. Ecological Research Series, EPA-R3-73-009, Office of Res. and Monitoring, U. S. Environ. Protection Agency, Washington, D. C.; Fish Health News, 2(3): p. 9.

Sixteen water quality parameters of importance to EPA were monitored for one year at six trout hatcheries located in Utah. In addition, bottom fauna was examined. The investigator found that intensive trout production did cause degradation of water quality. The degradation was less when the initial supply was of high quality. Fish food organisms were increased below hatchery outfalls which the author feels is desirable from a fishery viewpoint. However, he points out that public health and water quality standards may require cleanup of hatchery effluent before discharge.--R. L. Herman

16842. Kimura, Makoto. 1973. INCONSISTENCIES IN LOCATING THE FIRST ANNULUS OF PACIFIC SARDINES. Calif. Fish and Game, 59(3): 191-195.

A special scale reading session designed to bring together old and new scale readers to compare the criteria for estimating the first annulus in sardine scales (L_1), examined scales collected from the 1941 through 1962 sardine landings. Estimates of L_1 by the original readers were consistently lower than those of the newer readers. The reported increase in Pacific sardine length at the formation of first annulus appears to be due to a change in the older reader's criteria for the position of the first annulus. In addition, there was a gradual replacement of the older readers by newer ones who consistently read higher and thus overestimated L_1. Hence, it appears that there was no real change in sardine growth rates during these years. (Auth.)

16843. Sakaguchi, Hiromi (Fish. Exp. St. Hyogo-ken, Nakasaki-cho, Akashi, Japan). 1972. ON THE EFFECTS OF AGRICULTURAL CHEMICALS UPON FISH. I. CHANGES OF CHEMICAL COMPONENTS IN SERUM AND LIVER OF CARP EXPOSED TO ORGANOPHOSPHATE COMPOUNDS. Bull. Jap. Soc. Sci. Fish., 38(6): 555-560. In Japanese with English abstract.

Although on the toxicity of agricultural chemicals upon fishes many studies have been performed, most of them are concerned with the estimation of lethal concentration for test animals. However in the study of notorious effect of these agents upon fish, the physiological changes caused by fairly low concentrations of chemicals should not be overlooked. The present paper deals with the estimation of physiological changes in carp, Cyprinus carpio, exposed to diluted organophosphate compounds, malathion, dipterex and DDVP. Fish were kept in 500 l vinyl resin tanks containing different levels of diluted chemicals. After 48-hour exposure, the fish were sacrificed for chemical analyses. In all lots of fish treated with the agricultural chemicals, activities of serum transaminases (GOT and GPT) were elevated and that of cholinesterase was decreased. Changes in serum glucose, triglyceride and total cholesterol content were conspicuous, but there was no remarkable change in protein content. In DDVP-treated fish, regardless of DDVP concentration, the content of liver glycogen was reduced to three fourths that of control animals. On the other hand, fat content was elevated in the fish kept in 1 ppm solution but lowered in 5 and 10 ppm groups.

16844. Menzel, Bruce W., and Edward C. Raney (Dept. of Zool and Entomol., Iowa State Univ., Ames, Iowa). 1973. HYBRID MADTOM CATFISH, Noturus gyrinus X Noturus miurus, FROM CAYUGA LAKE, NEW YORK. Amer. Midl. Nat., 90(1): 165-176.

Three additional specimens of the hybrid combination Noturus gyrinus X N. miurus are described. Morphologically, they are similar to those previously reported by Trautman (1948) and Taylor (1969), being generally intermediate between the parental species. Hybrid vigor is indicated in one individual by its large size and robustness. All four specimens are females but only the largest appears to have been capable of reproduction. Ecological observations suggest that a combination of factors, including perhaps submarginal habitat and unequal numbers of the parental species, resulted in mismating to produce the hybrids. Madtoms may lack ethological barriers to hybridization which is characteristic of other ictalurids. (Authors)

16845. Sazaki, Marcus, William Heubach, and John E. Skinner. 1973. SOME PRELIMINARY RESULTS ON THE SWIMMING ABILITY AND IMPINGEMENT TOLERANCE OF YOUNG-OF-THE-YEAR STEELHEAD TROUT, KING SALMON AND STRIPED BASS. Final Report for Anadromous Fisheries Act Project, Calif. AFS-13, Development of Fish Screen Design Criteria, 31 p.

Laboratory tests were conducted to determine the swimming ability and impingement tolerance of the young of selected anadromous fish species. The tests were undertaken to develop biological criteria to design a fish screen for the proposed joint State-Federal Peripheral Canal. This report reflects only that portion of a much larger study program, which involved funding under the Anadromous Fisheries Act. Both king salmon (36-56 mm) and steelhead trout (22-36 mm) withstood impingement on a screen of 16 meshes to the inch, at water velocities of 2.5 fps for up to six minutes. Survival was rarely less than 100 percent. Swimming capability is related directly to size and inversely with velocity. The highest velocity at which 90% of the (47-56 mm) salmon could swim for six minutes was 0.7 fps. Less than 85% of the steelhead under 36 mm were able to swim for six minutes at 0.2 fps. All steelhead were impinged at 1.0 fps and all king salmon at 1.5 fps. The striped bass tested ranged from 10-50 mm in length. The smaller fish were impinged at velocities as low as 0.4 fps. A velocity of 2.5 fps was required to impinge the largest fish. Mortality from impingement also was related to the size of the fish. For fish 10-50 mm long velocities on the order of 0.5 fps or less were required to attain a survival of 80 percent for the six minute test period. Seventy percent or more of the striped bass eggs impinged survived the 6 minute test period at velocities up to 0.8 fps. (Authors' summ.)

16846. Austin, Herbert M., and Clarence R. Hickey, Jr. (N. Y. Ocean Sci. Lab., Montauk, New York 11954). 1973. SPINAL CURVATURE IN THE ATLANTIC SILVERSIDES, Menidia menidia (Linnaeus), AND THE ATLANTIC MENHADEN, Brevoortia tyrannus (Latrobe). Chesapeake Science, 14(2): 146-147.

16847. Clayton, J. W., R. E. K. Harris, and D. N. Tretiak (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitobe R3T 2N6, Canada). 1973. IDENTIFICATION OF SUPERNATANT AND MITOCHONDRIAL ISOZYMES OF MALATE DEHYDROGENASE ON ELECTROPHEROGRAMS APPLIED TO THE TAXONOMIC DISCRIMINATION OF WALLEYE (Stizostedion vitreum vitreum), SAUGER (S. canadense), AND SUSPECTED INTERSPECIFIC HYBRID FISHES. J. Fish. Res. Bd. Canada, 30(7): 927-938.

Walleye (Stizostedion vitreum vitreum) and sauger (S. canadense) commonly yield four isozymes of malate dehydrogenase (MDH) in electropherograms of white muscle extracts from individual homozygous fish. The heat stability of each isozyme as well as reactivity with nicotinamide-adenine dinucleotide (NAD) and NAD analogues have been investigated by measuring the density of each isozyme directly on the electropherograms, after the usual specific staining procedure that links malate oxidation to tetrazolium dye reduction. At least two kinds of supernatant and one kind of mitochondrial MDH in individual fish of each species was demonstrated. Relative abundance of the various isozymes varies with the tissue of origin. In liver, only one heat stable isozyme is observed in both species, and it is likely constituted mainly of supernatant MDH. In heart tissue four isozymes are observed and the liver supernatant form also predominates. In white muscle the two kinds of supernatant MDH appear to be synthesized in comparable amounts and, including the mitochondrial MDH, four isozymes of nearly equivalent catalytic activity are produced. In walleye the three kinds of MDH homozygotes all showed similar enzymatic properties of their corresponding isozymes. In contrast to the polymorphic nature of walleye MDH isozymes the closely related sauger are monomorphic for MDH, and a number of analogous isozymes have identical electrophoretic mobility in the two species. More significantly, the major mitochondrial MDH isozymes have different mobility in each species. This fact is suggested as a taxonomic criterion to distinguish the two species. Some very rare fishes, evidently interspecific hybrids, produced three mitochondrial MDH isozymes. It was also possible to hybridize walleye and sauger MDH isozymes in vitro to produce phenotypes indistinguishable from presumed wild hybrid fishes. (Authors)

16848. Richards, C. E. (Va. Inst. of Marine Sci., Gloucester Point, Virginia 23062). 1973. AGE, GROWTH AND DISTRIBUTION OF THE BLACK DRUM (Pogonias cromis) IN VIRGINIA. Trans. Amer. Fish. Soc., 102(3): 584-590.

Black drum were sampled from pound nets, haul seines, sport catches, and exploratory trawl and seine gear from 1959 through 1970 in a study of growth and distribution. Juveniles as small as 22 mm and adults up to 132 cm length and 46 kg (101.25 lbs) were examined. No sex differential in growth occurred and mean lengths for age-groups I, II and III were 223 mm, 406 mm and 562 mm respectively. Weights for the same age sequence are 0.17, 1.09 and 2.93 kg. More than one scale ring is apparently formed each year after the fourth year. Growth equations are: L_t in cm = $147.4\ (1 - e^{-0.158(t+0.04)})$, and W_t in kg = $52.9\ (1 - e^{-0.100t})^3$. During the years 1962-1970, 69.6% of commercial landings by weight and 97.6% of citation sport catches by number occurred in the period April-June. Ocean surface temperatures at Chesapeake Light averaged 17.54 C with a standard deviation of 2.69 degrees coincidentally on days of sport catches April through June. (Auth.)

16849. Edwards, D. J. (Marine Sci. Labs., Menai Bridge, Anglesey, Wales). 1973. THE EFFECTS OF DRUGS AND NERVE-SECTION ON THE RATE OF PASSAGE OF FOOD THROUGH THE GUT OF THE PLAICE, Pleuronectes platessa (L.). J. Fish Biol., 5(4): 441-446.

Plaice were force-fed pieces of Arenicola containing barium sulphate paste. The passage of the contrast medium through the stomach and intestine of the fish was followed by an X-ray technique and timed. The effects of drugs administered orally or by injection on time of retention of food in the stomach were investigated. Carbachol (2 mg/kg orally, 0.01 mg/kg injected) increased the rate of gastric emptying. Acetylcholine (100 mg/kg orally, 10 mg/kg injected) and eserine (5 mg/kg orally or injected) had no effect. 5-HT (5 mg/kg injected) caused some increase in rate, while atropine (1 mg/kg injected) greatly slowed gastric emptying. Section of both vagus nerves supplying the stomach greatly increased gastric emptying rate, but only marginally affected rate of passage of food through the intestine. Spinal section had no detectable effect on gastric emptying. The vagal nerve supply to the plaice stomach may contain a mixture of excitatory and inhibitory fibres. The excitatory fibres elicit contractions of gastric smooth muscle through cholinergic, muscarinic receptors. (Auth. summ.)

16850. Fast, Arlo W. (Dept. of Fish. & Wildl., Michigan State Univ., East Lansing, Michigan 48823). 1973. SUMMERTIME ARTIFICIAL AERATION INCREASES WINTER OXYGEN LEVELS IN A MICHIGAN LAKE. Prog. Fish-Cult., 35(2): 82-84.

Three months of summertime artificial aeration using compressed air resulted in a large increase in winter oxygen concentrations during ice cover. This increase is attributed to a more thorough oxidation of organic matter with a resultant decrease in the winter oxygen consumption rate, and a larger reserve of oxygen at the time of ice cover. Both of these conditions are attributed to artificial aeration. (Auth.)

16851. Solly, S. R. B., and D. L. Harrison (Wallaceville Animal Res. Centre, Ministry of Agric. and Fish., Wellington, New Zealand). 1972. DDT IN SOME NEW ZEALAND MARINE AND FRESHWATER FAUNA. N. Z. Journal of Marine and Freshwater Research, 6(4): 456-462.

Ten species of fish, crustaceans, and molluscs, taken from inland and coastal waters of New Zealand in 1969-70, mostly before the legislative ban on DDT, were analysed for residues of lindane, polychlorinated biphenyls (PCB), and DDT and its metabolites. DDE was the only organochlorine compound detected in six species, and DDE was the major residue in all others. DDD and/or DDT was present only in eels (Anguilla australis schmidtii, A. diefenbachii), groper (Polyprion oxygeneois), and some flounder (Rhombosolea plebeia). No lindane or PCB were found in any of the samples. The range of total DDT levels in edible flesh was 0-0.20 parts per million (on a fresh tissue basis) and the mean residue level for all specimens was 0.02 ppm. The incidence of residues appeared to be related to the regional use of DDT. (Authors)

16852. Walter, Gilbert G. (Dept. of Math. and Center for Great Lakes Studies, Univ. of Wisconsin-Milwaukee, Milwaukee, Wisconsin 53201). 1973. DELAY-DIFFERENTIAL EQUATION MODELS FOR FISHERIES. J. Fish. Res. Bd. Canada, 30(7): 939-945.

Two new "simple" fishery models based on delay-differential equations are introduced and compared to three currently used differential equation models. These new models can account for reproductive lag and allow oscillatory behavior of population biomass, but require only catch and effort data for their application. Equilibrium levels are calculated for both models and examples of various types of growth curves are given. Levels of fishing effort which maximize yield are calculated and found in one case to depend on the previous population and in the other to be constant. (Auth.)

16853. White, Steven T., and Dale C. Wallace (Dept. of Biol., East Mich. Univ., Ypsilanti, Michigan). 1973. DIEL CHANGES IN THE FEEDING ACTIVITY AND FOOD HABITS OF THE SPOTFIN SHINER, Notropis spilopterus (Cope). Amer. Midl. Nat., 90(1): 200-205.

A study of the diel changes in the feeding activity of Notropis spilopterus (Cope) in the Huron River near Ann Arbor, Michigan, was based on samples taken at 3-hr intervals for 24 hrs. The food in the stomachs of 263 spotfin shiners was examined. Based on stomachs with food, Trichoptera larvae, represented mainly by hydropsychids, accounted for the greatest volume (33%). Diptera larvae, represented by simulids and chironomids, were most frequent (50%). Both of these food items occurred in a high percentage of stomachs (54%). The major peak in stomach fullness occurred at 9:00 PM when 74% of all stomachs were over 50% full. Most stomachs from fish collected at midnight were empty (85%). Feeding activity increased by 6:00 AM, but at a relatively low intensity. Fewer fish were feeding at noon than at 6:00 AM. However, at noon the feeding intensity was somewhat greater. During the day, especially at noon, smaller fish were feeding more intensely than larger fish. Both Trichoptera and Diptera larvae constituted an important proportion of the food through most of the daylight hours. Trichoptera larvae were much less important at dusk than Diptera larvae.

16854. Nagayama, Fumio, Hiroshi Ohshima, and Kazutami Umezawa (Tokyo Univ. of Fisheries, Konan 4, Minato-ku, Tokyo, Japan). 1972. DISTRIBUTION OF GLUCOSE-6-PHOSPHATE METABOLIZING ENZYMES IN FISH. Bull. Jap. Soc. Sci. Fish., 38(6): 589-593.

Distribution of hexokinase, glucose-6-phosphate dehydrogenase (G6PD), 6-phosphogluconate dehydrogenase (6PGD), phosphoglucomutase (PGM), phosphoglucose isomerase (PGI), and glucose-6-phosphatase (G6Pase) in fish tissue was investigated to estimate the latent activity of glucose metabolism. The hepatic hexokinase activity of fish, which is regarded as an activity of glucose uptake into the metabolic pathway, is 1/3-1/7 that of the reported value for rat liver, and there are no extreme differences among the activities of the four species investigated. From the activities of hepatic enzymes relating to the Embden-Meyerhoff pathway (PGM and PGI) and to the hexosemonophosphate shunt (G6PD and 6PGD), grass carp is considered to possess the strongest latent activity of glucose metabolism, being followed by eel, carp, and rainbow trout.

16855. Gunning, Gerald E., and Anthony V. LaNasa (Dept. of Biol., Tulane Univ., New Orleans, Louisiana 70118). 1973. ENVIRONMENTAL EVALUATION BASED ON RELATIVE GROWTH RATES OF FISHES. Prog. Fish-Cult., 35(2): 85-86.

A spot-check environmental evaluation of a polluted river was conducted based on relative growth rates of the blacktail shiner, Notropis venustus, in polluted and unpolluted sections. A single sample of 741 fish was collected in January 1971 from the Pearl River, Louisiana. The difference in growth rates for fishes in unpolluted and polluted sections was statistically significant. Such spot-checks could indicate the need for pollution abatement programs. (Authors)

16856. Mahoney, John B., Frederick H. Midlige, and David G. Deuel (NMFS, Middle Atlantic Coastal Fish. Center, Sandy Hook Lab., Highlands, New Jersey 07732). 1973. A FIN ROT DISEASE OF MARINE AND EURYHALINE FISHES IN THE NEW YORK BIGHT. Trans. Amer. Fish. Soc., 102(3): 596-605.

A fin rot disease reached epizootic proportions in 1967 among at least 22 species of marine and euryhaline fishes in the New York Bight and has continued to occur annually to the present time. Fin necrosis was the consistent external sign of the disease; other external pathological changes included skin hemorrhages, skin ulcers and, occasionally, blindness. Bluefish, summer flounder, winter flounder, and weakfish were the principal species affected. Results of these studies indicate a bacterial cause. Bacteria of three genera, Aeromonas, Vibrio and Pseudomonas are likely implicated. Similar epizootics among freshwater fishes have been associated with unsanitary conditions in aquaria and with water pollution in nature. The epizootic primary center, lower New York Harbor, is grossly polluted with sewage and industrial wastes. We suspect pollution had a role in the disease. (Authors)

16857. Cannon, L. R. G. (Depts. of Zool. and Parasit., Univ. of Toronto, Toronto 5, Ontario, Canada). 1973. DIET AND INTESTINAL HELMINTHS IN A POPULATION OF PERCH, Perca flavescens. J. Fish Biol., 5(4): 447-457.

In 1967 and 1968 1310 Perca flavescens (Mitchill) were examined from Lake Opeongo, Ontario for changes in five diet categories and in incidence of eight intestinal helminths in relation to seasons, host size and sex. Male fish were less common than females and were smaller. A high proportion of fish (57.7%) had empty stomachs, but of the four types of foods taken microcrustacea were high in spring, late summer and again in early winter; insects increased in summer with another peak in autumn; crayfish had a small peak in spring and a larger one in autumn; and fish were lowest in summer. Males ate more smaller foods (microcrustacea) than females, but females ate more larger foods (crayfish and fish); no sex difference was seen with regard to insects or empty stomachs. Male fish ate very few larger items, but females showed an increase in food size with increasing size of fish. There was no seasonality in incidence of fish free of all parasites, but two trematodes Bunodera sacculata Van Cleave & Mueller and B. luciopercae (Müller), and one cestode Proteocephalus pearsei La Rue showed seasonality with populations lowest in fish in summer; and one trematode Crepidostomum cooperi Hopkins and one nematode Dacnitoides cotylophora Ward & Magath showed seasonality with populations highest in summer. In addition one cestode Bothriocephalus sp., one nematode Spinitectus gracilis Ward & Magath and one acanthocephalan Leptorhynchoides thecatus (Linton) showed no seasonality, perhaps on account of the low incidence in the case of Bothriocephalus sp. and L. thecatus. No parasites were more common in males, but two (P. pearsei and L. thecatus) were more common in females. In both males and females, with increasing size fish, (1) fish free of all parasites decreased, but (2) incidence of C. cooperi increased. Incidence of B. luciopercae, Bothriocephalus sp., S. gracilis and L. thecatus all increased with increasing size of fish only in females. The relationship between diet and incidence of intestinal helminths is discussed in the light of what is known of their life cycles. The exercise illustrates our ignorance of population ecology of fish parasites and the interactions of parasites and their host populations. (Auth.)

16858. Thorson, Lee C., and Mary Ellen Engett (Sci. Publns Staff, NMFS, Seattle, Washington). 1973. FISHERY PUBLICATIONS, CALENDAR YEAR 1967: LISTS AND INDEXES. NOAA Technical Report NMFS CIRC-381, 22 p.

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration (until October, 1970 the Bureau of Commercial Fisheries of the U. S. Fish and Wildlife Service) in calendar year 1967 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: Circular, Data Report, Fishery Industrial Research, Fishery Leaflet, and Special Scientific Report-Fisheries. (Authors)

16859. Becker, C. D., and T. O. Thatcher (Pacific Northwest Labs., Battelle Mem. Inst., Richland, Washington 99352). 1973. TOXICITY OF POWER PLANT CHEMICALS TO AQUATIC LIFE. U. S. Atomic Energy Comm., WASH-1249, UC-11.

A review was made to determine the various chemicals actually or potentially associated with the operation and maintenance of nuclear power plants and cooling tower structures. A tentative list of these chemicals is presented. The in-plant application of the various chemicals, their reactions with other compounds and water, and the resulting materials that may occur in plant effluent discharges are briefly discussed. Data from technical publications concerning the specific toxic levels of power plant chemicals and their products to aquatic life are tabulated (Tables A to R) under the following categories: acids; acrolein; arsenates and arsenites; ammonia, amines, and related compounds; boron; carbonates; chlorine and bromine; chlorinated and/or phenylated phenols; chromates; cyanurates and cyanides; hydrazine compounds; hydroxides; metals and their salts; nitrates and nitrites; potassium compounds; phosphates; silicates; sulfates, sulfides, and fluorides. (Authors)

16860. Hewitt, G. C. (Zool. Dept. Victoria Univ. of Wellington, Wellington, New Zealand). 1972. SURVEY OF NEW ZEALAND TROUT HATCHERIES FOR WHIRLING DISEASE CAUSED BY Myxosoma cerebralis. N. Z. Journal of Marine and Freshwater Research, 6(4): 463-468.

Fourteen hundred trout, mainly Salmo gairdneri, supplied by the four Government and nine Acclimatization Society hatcheries in New Zealand were examined for the presence of spores of Myxosoma cerebralis (Hofer, 1903) (Protozoa: Myxosporida) in their head cartilage. The only positive result obtained was of a 24% infection rate in fish from the Otago Acclimatization hatchery at Waitati, near Dunedin, which has since been closed down. Sixty fish were examined from Acclimatization Societies hatcheries and 200 from Government Hatcheries to give a 95% chance of detecting infections of 5% and 1.5%, respectively, of the fish in these hatcheries. A formula is given for estimating sample sizes on the bases of probable infection rates and the degree of certainty of detection that is required. (Auth.)

16861. Timoshina, L. A. (State Res. Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, USSR). 1972. EMBRYONIC DEVELOPMENT OF THE RAINBOW TROUT (Salmo gairdneri irideus (Gibb.) AT DIFFERENT TEMPERATURES. J. Ichthyol., 12(3): 425-432.

The embryonic development of the rainbow trout (Salmo gairdneri irideus Gibb.) was studied at different temperatures (2, 5, 7, 10 and 13° C). We studied the processes of morphogenesis, growth rate and the viability of the eggs and larvae (percentage of mortality), and determined the weight and condition of the larvae after hatching. It was found that temperatures of 5 and 7° C were most conducive to the development of the trout eggs, since development was completed fairly rapidly, the eggs hatched at around the same time, the larvae were large, active and viable and the mortality of eggs and larvae was lowest. High and low temperatures (2, 10 and 13° C) yielded poor results. Development lasted for a very long time at 2° C and hatching was extended 25 days. The larvae hatched at these low and high temperatures were small, weak and nonviable. The mortality of eggs and larvae was appreciable. Gradual raising of the temperature of development from 5° to 10° C toward the time of hatching and to 13° C after hatching was very favorable, whereas complete development at constant high temperatures (10 and 13° C) did not yield good results.

16862. Phelps, R. P. 1971. KENTUCKY FISH KILL. Newsletter SE Coop. Fish Disease Project, 8: 1.

A massive fish kill in tributaries of the Ohio River near Maysville, Kentucky was caused by 3 genera of protozoans Ichthyophthirius, Trichodina, and Trichophrya. Secondary bacterial infection occurred. A similar kill occurred on the Coosa River in Alabama in 1962.

16863. Jensen, Kjell W. (Ministry of Agric., Vollebekk, Norway). 1972. ON THE DYNAMICS OF AN EXPLOITED POPULATION OF BROWN TROUT (Salmo trutta, L.). Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 74-84.

The dynamics of a population of brown trout in a mountain lake in S. E. Norway were studied on material collected in the years 1969-70. Brown trout was the only fish species in the lake, and fishing effort and yield were controlled during the two years. Instantaneous natural mortality was estimated as M = 0.21 by means of tagging in two years. Ricker's method was used to calculate the equilibrium yield. Corrected values for the instantaneous fishing mortality, F, were worked out from data on gill-net selection. The estimated equilibrium yield based on the 1969 population parameters was close to the observed yield in 1969. An estimate of population size based on the model was close to a Petersen estimate of the population. Theoretical curves for equilibrium yield at varying amounts of fishing effort were constructed for gill-net fishing with four different mesh sizes. The author believes these curves to be of very limited use for yield predictions because the density-dependence of trout growth has not yet been incorporated in the calculations. (Auth. summ.)

16864. Ward, James V. (Dept. of Environ., Population, and Organismic Biol., Univ. of Colo., Boulder, Colorado 80302). 1973. MOLYBDENUM CONCENTRATIONS IN TISSUES OF RAINBOW TROUT (Salmo gairdneri) AND KOKANEE SALMON (Oncorhynchus nerka) FROM WATERS DIFFERING WIDELY IN MOLYBDENUM CONTENT. J. Fish. Res. Bd. Canada, 30(6): 841-842.

Concentrations of molybdenum in tissues of rainbow trout (Salmo gairdneri) from three waters increased only slightly with increase in molybdenum concentration of the water. Fish from high (300 ppb) molybdenum water had mean concentrations of 13-332 ppb on a wet-weight basis; those from low (6 ppb) molybdenum water, 10-146 ppb; and those from trace molybdenum water, 5-118 ppb. Rainbow trout exhibited generally higher molybdenum concentrations than did kokanee salmon (Oncorhynchus nerka) in high molybdenum water. A possible plateau mechanism concerning molybdenum accumulation by salmonids is discussed. (Auth.)

16865. Wilbur, Robert L., and Eugene W. Whitney (N. C. Coop. Fish. Unit, N. C. State Univ., Raleigh, North Carolina 27607). 1973. TOXICITY OF THE HERBICIDE KURON (SILVEX) TO BLUEGILL EGGS AND FRY. Trans. Amer. Fish. Soc., 102(3): 630-633.

Experimental treatment with herbicide Kuron of two alligatorweed infested North Carolina streams was initiated by the U. S. Army Corps of Engineers in summer, 1965. Surveillance of fish and invertebrate populations was provided by the U. S. Bureau of Sport Fisheries and Wildlife. The effects of Kuron on bluegill eggs and fry were examined under laboratory conditions to provide insight on how reproduction of the sunfish family may have been affected by Kuron treatments applied to the streams. Eggs from each of nine bluegills were treated with Kuron concentrations of 0.0 ppm (control), 0.1 ppm, 1.0 ppm, 5.0 ppm, and 10.0 ppm acid equivalents. Analysis of variance indicated that hatching was not significantly affected by treatments but that survival of fry to an age of 6 days was affected by the treatments. No fry survived at 10.0 ppm and only a token few survived the 5.0 ppm treatment. (Authors)

16866. Hatai, Kishio, Shoji Terada, Takashi Aoki, and Tsutomu Watanabe (Product Development Lab., Sankyo Co., Tokyo, Japan). 1973. STUDIES ON MENOMYCIN (FLAVOPHOSPHOLIPOL) - II. THE EFFECT OF MENOMYCIN ON R FACTOR CARRYING BACTERIA IN THE INTESTINAL TRACTS OF EELS. Fish Pathology, 7(2): 109-114; Fish Health News, 2(3): p. 8.

Eels carrying in their intestines bacteria with infectious resistance factor "R" were treated with food containing 50 ppm of Menomycin for 80 days. This diet decreased the number of R bacteria in the intestinal tract of eels. Therefore such treatment is suggested for control of bacteria resistant to other antibiotics. -- S. F. Snieszko

16867. Brynildson, Oscar M., and James J. Kempinger. 1973. PRODUCTION, FOOD AND HARVEST OF TROUT IN NEBISH LAKE, WISCONSIN. Dept. of Nat. Res., Madison, Wisconsin, Technical Bulletin No. 65, 20 p.

In June 1967, stocks of 4,500 age 0 brown trout and 4,500 age 0 rainbow trout were stocked into Nebish Lake, a soft-water lake which had been chemically treated in 1966 to remove all resident fish. Relative production, growth, harvest and food of the two species of trout were compared for 4-1/2 years after their release. Rainbow trout had the higher production of the two stocks because they survived better and grew faster than the brown trout. Poundage of rainbow trout in the angler's catch during the first 2 years of fishing was higher than the total poundage of brown trout produced in the lake during 4-1/2 years. For each pound of brown and rainbow trout stocked, 5.2 and 15.0 pounds, respectively, were harvested by anglers. Copepods were not found in the trout stomachs. Daphnia 1 mm and larger was the staple food of brown and rainbow trout less than 16 inches, whereas fish was the prominent food of larger trout. After 3 years of grazing by trout and by a burgeoning population of yellow perch, three of four species of Daphnia disappeared from Nebish Lake and small Bosmina longirostris, which had not appeared in the Clarke-Bumpus samples before, became the dominant open-water cladoceran. After 4 years of grazing by perch, two species of Daphnia re-appeared but in relatively low numbers. Based on these data, it appears that trout growth can be rapid in a soft-water lake containing large species of Daphnia if the lake's production capacity is not taxed by large stocks of planktivorous fishes. (Authors)

16868. Smith, W. G. (Middle Atlantic Coastal Fish. Center, NMFS, NOAA, Highlands, New Jersey 07732). 1973. THE DISTRIBUTION OF SUMMER FLOUNDER, Paralichthys dentatus, EGGS AND LARVAE ON THE CONTINENTAL SHELF BETWEEN CAPE COD AND CAPE LOOKOUT, 1965-66. NOAA Fishery Bulletin, 71(2): 527-535.

Eggs and larvae of summer flounder, Paralichthys dentatus, were collected with Gulf V plankton nets between Cape Cod, Mass., and Cape Lookout, N.C., during a 1-year survey of continental shelf waters. The most productive spawning grounds were located off New York and New Jersey. Spawning began in northern parts of the survey area, progressed southward with the season, and ended off Cape Lookout. We collected eggs north of Chesapeake Bay from September to December and south of the Bay from November to February, and larvae north of Chesapeake Bay from September to February and south of the Bay from November to May. Most spawning occurred at temperatures between 12° and 19°C, but the pelagic eggs were caught at mean temperatures from 9.1° to 22.9°C, and the larvae from 0° to 23.1°C. (Auth.)

16869. Gregory, L. A., and J. S. Loch (Resource Mgmt Branch, Fisheries Serv., Operations Directorate, Central Region, Winnipeg, Manitoba, Canada). 1973. A BENTHOS SURVEY (1972) IN THE NORTH SASKATCHEWAN RIVER IN THE VICINITY OF THE PRINCE ALBERT PULP COMPANY, PRINCE ALBERT, SASKATCHEWAN. Environ. Canada, Tech. Report Series No. CEN T-73-2, 17 p.

A benthic survey was conducted in the vicinity of the Prince Albert Pulp Mill. Substrate analysis showed little organic content and suggested that the primary and secondary treatments undertaken at the pulp mill were effective in removing most of the wood fiber from the effluent. The sand-clay substrate restricted the number of representative benthic groups present. Therefore the interpretive value of quantitative diversity indices and information-analysis was limited. Qualitative assessments using the chironomid genera present suggested that some pollutant-effects existed below the mill's outfall. (Authors)

16870. Smith, Allan K. 1973. FISH AND WILDLIFE RESOURCES OF THE UMATILLA BASIN, OREGON, AND THEIR WATER REQUIREMENTS (REVISED). Environmental Investigations, Completion report, Federal Aid to Fish Restoration, Oregon State Game Comm., Portland, Oregon, 70 p., illus.

16871. European Inland Fisheries Advisory Commission (FAO, Rome, Italy). 1973. WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH. REPORT ON DISSOLVED OXYGEN AND INLAND FISHERIES. EIFAC Technical Paper No. 19, 10 p.

Laboratory data point to certain levels of DO associated with impairment or alteration of fish survival, growth, reproduction, swimming ability and behaviour; imcomplete as the data are, with respect to the distributions of the responses within fish populations in given physiological and behavioural states, they must form the present basis of any DO criteria for fish and fisheries, and have had to be used to derive the tentative minimum steady levels proposed here for normal successful fulfillment of the life cycle, assuming other environmental factors are favorable including the absence of poisons. They suggest that, in general, a minimum of 5 mg/l would be a satisfactory limit for most of the processes required for a successful fish life cycle, though it may be unnecessarily high merely to ensure satisfactory survival of the fish and growth of the juveniles. Consequently fluctuations about 5 mg/l or any reduction below 5 mg/l would have a greater effect on some processes than on others; the greater effect of fluctuations in DO on juvenile growth as compared with that on growth of larvae has already been mentioned, but clearly fecundity, hatch of eggs, and larval morphology and survival, as well as the upstream movement of migratory salmon and schooling behaviour of some species, including shad, would also be adversely affected by levels below 5 mg/l that would not necessarily affect either the survival of individuals or the upstream migration of shad. This is consistent with the mere presence of fish observed in polluted rivers and estuaries where the DO is well below saturation and exhibits a wide variation within a year; this would suggest minimum acceptable values (for ranges of variation) of much less than 5 mg/l - probably less than 1 mg/l, for example, for coarse fish in the River Trent. (Authors' summ.)

16872. Savel'yeva, E. A., and T. F. Shuvatova (Azov Fish. Res. Inst. (AzNIIRKh), Rostov-on-Don, USSR). 1972. SOME CHARACTERISTICS OF THE PARENT-PROGENY RELATIONSHIP IN THE DON PIKE-PERCH [Lucioperca lucioperca (L.)]. J. Ichthyol, 12(2): 241-248.

Characteristics of the parent-progeny relationship in the Don pike-perch were investigated in connection with the development of a hatchery method of reproduction for this species. Experiments were carried out in three fish size groups. It was established that the quality of the progeny obtained was dependent on the initial physiological condition of the spawners. The maturation period after a pituitary injection was shortest in females of the middle size group. These also had the best reserves of trophic substances (fat content of muscles, protein in liver and eggs). Young females had the lowest level of egg fertilization. The quantity of yolk in the egg varied as a function of the size of the females. The highest rate of metabolic processes was observed in the progeny of females of the middle age group. A high positive linear correlation was established between the fat content of the muscles of the females, the protein content of the eggs and the survival rate of the embryos. The duration of the embryonic development of the pike-perch was dependent on the quality of the eggs. Larvae obtained from medium sized and large females of the medium age group were the most viable. (Authors)

16873. Zolotova, Z. K., and L. V. Khromov. 1970. THE WEEDING ROLE OF GRASS CARP. Rybovodstvo i Rybolovstvo, (4): 8; Weed Abstracts, 21(6): 3017.

In experiments at the Chitukskii Fish Farm in the Krasnodar District in 1964-67, grass carp yearlings weighing 150 g each were stocked at 1250 fish (79 kg/ha) in a 0.42-ha pond; yearling silver carp and common carp fingerlings were also stocked. Changes in the species composition of aquatic vegetation, plant weight and the numbers of stems/m^2 were assessed at intervals. On 25 June (2 weeks after stocking) about 30% of the pond was infested with club-rush (Scirpus tabernaemontani), reed mace (Typha latifolia and T. angustifolia), reed (Phragmites communis) and bur-reed (Sparganium ramosum). Sixty percent of the bottom of the pond was covered with a thick carpet of stream-bank sedge (Carex riparia). Soft vegetation was cleared by the end of June and the wt. of C. riparia was reduced from 1200 to 300 g/m^2. By the end of July, Carex spp. and Sparganium spp. had

disappeared leaving only fibrous vegetation dominated by S. tabernaemontani. In August the fish attacked the fibrous plants, broke down Scirpus spp. 3 m high and chewed off P. communis at the base, consuming also the rhizomes. By 20 August the pond was almost clear of weed stands and the total area of Phragmites and Typha spp. was reduced by > 90%. The grass carp had cleared within 70 days a pond with a total vegetative production in July of 16.2 t/ha.

16874. McBride, J. R., and U. H. M. Fagerlund (Fish. Res. Bd. of Canada, Vancouver Lab., Vancouver 8, British Columbia, Canada). 1973. THE USE OF 17 α-METHYLTESTOSTERONE FOR PROMOTING WEIGHT INCREASES IN JUVENILE PACIFIC SALMON. J. Fish. Res. Bd. Canada, 30(8): 1099-1104.

The effect of 17 α-methyltestosterone feeding on the weight of juvenile coho salmon (Oncorhynchus kisutch) and on the weight, length, and condition factor of juvenile chinook salmon (O. tshawytscha) was determined. Significant increases in weight and length but not in condition factor were noted at all levels of steroid tested. Coho fed rations containing 10 mg/kg of the steroid for 42 days showed a 29% net weight gain and chinooks fed 1 mg/kg of the hormone for 84 days exhibited a 17% net weight gain over the respective control groups. A marked thickening of the skin was noted in the coho retained on diets containing 10 and 50 mg/kg of the steroid. This alteration was most evident in those fish fed the highest concentrations of hormone for the longest period. In the coho, diets containing 10 or 50 mg/kg of the hormone evoked marked degenerative changes in the testes. Less drastic alterations were noted in the testes of the chinooks retained on the 1 mg/kg test ration for 84 days. No apparent structural changes were noted in the ovary of any of the test fish. (Authors)

16875. Becker, C. D. (Pacific Northwest Labs, Battelle Mem. Inst., Richland, Washington 99352). 1973. AQUATIC BIOENVIRONMENTAL STUDIES IN THE COLUMBIA RIVER AT HANFORD 1945-1971. A BIBLIOGRAPHY WITH ABSTRACTS. Prepared for the U. S. Atomic Energy Comm., BNWL-1734, UC-48.

Publications prepared by Hanford staff scientists that deal with bioenvironmental studies in the central Columbia River during the period 1945 to 1971 are listed and abstracted. Four general topics are covered: 1) biology and ecology of river organisms, 2) thermal and chemical effects of reactor effluent discharges, 3) radioactivity releases from reactor operations, and 4) hydrology of the Columbia River. Over 400 publications are included. The abstracts provide an insight into the scope and depth of diverse studies supported by the United States Atomic Energy Commission in order to evaluate any impact on the aquatic ecosystem (and to provide related data) throughout the "plutonium production phase" of the Hanford operations. (Auth.)

16876. Timoshina, L. A., and A. A. Shabalina. 1972. EFFECT OF STARVATION ON THE DYNAMICS OF CONCENTRATION OF AMINO ACID AND FREE FATTY ACID IN RAINBOW TROUT. Hydrobiological Journal, 8(4): 36-41.

The changes of the concentration of free amino acids in blood serum and muscles and of free fatty acids in the blood of rainbow trout (Salmo gairdneri irideus Gibb.) after prolonged starvation are described. The set of the amino acids in the proteins was found to be stable.

16877. Havre, Gustav N., Bjarne Underdal, and Cath. Christiansen (Depts. of Biochem. and of Food Hygiene, Veterinary College of Norway). 1973. CADMIUM CONCENTRATIONS IN SOME FISH SPECIES FROM A COASTAL AREA IN SOUTHERN NORWAY. Oikos, 24(1): 155-157.

Cadmium concentrations in some fish species have been determined using atomic absorption spectrophotometry. The main steps in the analytical procedure are commented on. The cadmium concentrations were low, varying from 0.003 to 0.012 μg/g wet weight in cod, and from 0.002 to 0.029 μg/g, and 0.003 to 0.033 μg/g, in whiting and herring, respectively. The results could indicate a slightly greater accumulation of cadmium in fat fish as compared to lean fish. No correlation seems to exist between the cadmium concentration and the total weight of the fish. (Authors)

16878. Ivanova, M. N., and S. N. Polovkova (Inst. of the Biol. of Inland Waters, USSR Acad. of Sciences, Borok, Yaroslavl Province, USSR). 1972. TYPES OF SPAWNING GROUNDS AND SPAWNING ECOLOGY OF THE LANDLOCKED SMELT [Osmerus eperlanus (L.)] IN RYBINSK RESERVOIR. J. Ichthyol., 12(4): 625-633.

Published data indicate that the landlocked smelt [Osmerus eperlanus (L.)] has two types of spawning grounds ("lake" and "river") in individual bodies of water. Spawning grounds of both types are found in Rybinsk reservoir. The breeding grounds of the smelt in the lake and river parts of the reservoir are shown to differ in hydrologic regime, in the time of spawning and in the size and age composition of the spawning stocks. The bulk of the fish maturing for the first time (first of 1+ and 2+) spawn in the "lake" spawning grounds, while it is mainly repeat spawners which use the "river" spawning grounds. The use of different areas of the reservoir by the younger and older age groups during the spawning period considerably increases the reproductive efficiency of the entire smelt population.

16879. Turner, Bruce J. (Dept. of Zool., Univ. of Calif., Los Angeles, California). 1973. GENETIC DIVERGENCE OF DEATH VALLEY PUPFISH POPULATIONS: SPECIES-SPECIFIC ESTERASES. Comp. Biochem. Physiol., 46(1B): 57-70.

Starch gel electrophoretic patterns of soluble tissue carboxylesterases suggest that five closely related, allopatric, nominal Cyprinodon (pupfish) species from Death Valley and adjacent areas are genetically distinct. At least four of the five species have the same chromosome number and yield fertile hybrid progeny in laboratory crosses; all five have identical hemoglobin and myogen electropherograms. Inhibitor and heat-inactivation experiments allowed empirical distinctions among the species-specific esterases; these distinctions and hybrid data were used to formulate simple genetic hypotheses. Only one of the resolved esterases was detectably polymorphic; the polymorphism was confined to a single species, C. nevadensis. Another esterase zone was completely divergent among two allopatric populations of C. macularius. The species-specificity of some of the pupfish esterases and the ecological differences among their habitats suggest that the divergent esterases may be involved in adaptation to environmental parameters. The results are of obvious applicability to other closely related teleost morphospecies or populations of questionable genetic distinctness. (Auth.)

16880. Ebel, Wesley J., Donn L. Park, and Richard C. Johnsen (Northwest Fish. Center, NMFS, NOAA, 2725 Montlake Blvd East, Seattle, Washington 98112). 1973. EFFECTS OF TRANSPORTATION ON SURVIVAL AND HOMING OF SNAKE RIVER CHINOOK SALMON AND STEELHEAD TROUT. NOAA Fish. Bull., 71(2): 549-563.

The homing ability of adult fish that were captured during their seaward migration as juveniles and then transported downstream (from Ice Harbor Dam to Boneville Dam) was not diminished. Data from returning adults indicated survival of adult fish that had been transported downstream as juveniles was higher than that of fish not transported. The percentage of increased survival ranged from 50 to 300% depending on the river environment during the time of transport. Information on the timing of the seaward migration and the extent of mixing of seaward runs of spring and summer chinook salmon, Oncorhynchus tshawytscha, was also obtained. (Authors)

16881. White, F. H., C. F. Simpson, and L. E. Williams, Jr. (Dept. of Vet. Sci., Univ. of Florida, Gainesville, Florida). 1973. ISOLATION OF Edwardsiella tarda FROM AQUATIC ANIMAL SPECIES AND SURFACE WATERS IN FLORIDA. Journal of Wildlife Diseases, 9(3): 204-208.

Edwardsiella tarda was isolated from lakes and streams in North central Florida. This emerging enteric bacterial pathogen also was isolated from alligators (Alligator mississippiensis) and brown pelicans (Pelecannus occidentalis carolinensis) on several occasions, and from other species including the ring-billed gull (Larus delewarensis), bald eagle (Haliaeetus leucocephalus), great blue heron (Ardea herodias), sandhill crane (Grus canadensis), common loon (Gavia immer), and largemouth bass (Micropterus salmoides). Hemorrhagic enteritis was found in association with E. tarda in some of the species presented. (Authors)

16882. Dominy, C. Leslie (Environ. Prot. Service, Dept. of the Environ. of Canada, St. John's, Newfoundland, Canada). 1973. RECENT CHANGES IN ATLANTIC SALMON (Salmo salar) RUNS IN THE LIGHT OF ENVIRONMENTAL CHANGES IN THE SAINT JOHN RIVER, NEW BRUNSWICK, CANADA. Biological Conservation, 5(2): 105-113.

Deterioration of water quality as a result of the disposal of untreated organic and toxic wastes into the Saint John River Basin began when the River was first settled in 1604, and the amount of waste entering the River has increased substantially over the past two decades. Hydroelectric power developments constructed on the main stem of the River during this recent period have added to the problem by reducing the biological assimilative capacity of the River. The significance of these cultural influences for Atlantic salmon (Salmo salar) in the River has been to reduce the quality of its migration route to and from the sea, to eliminate some of its freshwater spawning and rearing areas, and to cause direct mortality of adult and juvenile salmon. As a consequence, the total salmon stock in the St. John River has declined by approximately 40 percent over the past two decades. The future prospects for conserving this valuable natural resource in the St. John River are moderately bright in view of current activities in water pollution abatement, effective regulation of the salmon fisheries, and large-scale artificial propagation. (Auth.)

16883. Sakamoto, Syuichi, and Yasuo Yone (Fish. Res. Lab., Kyushu Univ., Tsuyazaki, Fuduoka, Japan). 1973. EFFECT OF DIETARY CALCIUM/PHOSPHORUS RATIO UPON GROWTH, FEED EFFICIENCY AND BLOOD SERUM Ca AND P LEVEL IN RED SEA BREAM. Bull. Jap. Soc. Sci. Fish., 39(4): 343-348.

Dietary calcium and phosphorus content and the Ca/P ratio noticeably affect the growth rate and feed efficiency of red sea bream fingerlings. The dietary Ca/P ratio, optimal at a 340 mg % Ca level for the growth of the fingerlings, is about 1:2. The Ca/P ratio of blood serum reflect that the best growth of fish is achieved when fed with a diet that has a Ca/P ratio of 1:2.

16884. Pravda, Oldrich (Pedagogical Faculty, Ceske Budejovice, Czechoslovakia). 1973. ON THE INFLUENCE OF HERBICIDES ON SOME FRESHWATER ANIMALS. (Über den Einfluss der Herbizide auf einige Süsswassertiere). Hydrobiologia, 42(1): 97-142. In German with English Abstract.

Toxicity of fourteen herbicides has been determined for thirteen animal species: Planaria gonocephala, Tubifex sp., Lymnaea stagnalis, Daphnia pulex, Gammarus pulex, Asellus aquaticus, Micronecta minutissima, Esox lucius, Cyprinus carpio, Phoxinus phoxinus, Leucaspius delineatus, Perca fluviatilis, Rana temporaria, in 510 laboratory experiments. It was followed in three concentrations and expressed both in tables, by the value LT_{50} or by the various degree of damage of the organisms, and in graphs. The organisms were divided into four groups according to their sensitivity to herbicides: 1. organisms with high sensitivity; 2. sensitive; 3. medium sensitive; 4. little sensitive. From the point of view of the toxicity the herbicides were divided into three groups: 1. powerfully toxic; 2. medium toxic; 3. little toxic. A relationship between the intensity of toxicity and the chemical structure of herbicides was found. The first group includes herbicides on the basis of carbamates and phenols, the second group includes the derivates of phenoxyacetic acid, and the third group includes inorganic herbicides and those pertaining to the group of the chlorated organic substances. The mechanism of the toxic action was followed from the point of view of the mutual relationship of herbicide toxicity and the sensitivity of organisms. Eight basic types of this action were found. Special attention was paid to those types where significant reparation phases appeared during the experiments. Only inorganic herbicides and those from the group of the chlorated organic substances or eventually those on the basis of phenoxyacetic acid may be used for mass application in water economy. In all cases further complex investigations must be made concerning the influence on water biocenoses, as the recent data on the toxicity of herbicides with respect to several species of fish only are not sufficient. The use of herbicides from the group of phenols and carbamates should be prohibited in the neighborhood of water bodies. (Auth.)

16885. Waters, Thomas F., and Gary W. Crawford (Dept. of Entomol., Fish and Wildl., Univ. of Minn., St. Paul, Mennesota). 1973. ANNUAL PRODUCTION OF A STREAM MAYFLY POPULATION. Limnol. & Oceanogr., 18(2): 286-296.

The annual production of the mayfly Ephemerella subvaria McDunnough in a small central Minnesota stream, Luxembourg Creek, was estimated by four methods: a removal-summation method, the instantaneous growth method, the Allen curve, and the Hynes method. Basic data on standing crop and growth rates were obtained from a series of bottom samples covering the life cycle of the mayfly. The life history of E. subvaria was clear and simple, and the data were particularly amenable to production estimation by all four methods. The first three yielded estimates of annual production that generally agreed, ranging from 26.4 to 28.9 g m^{-2}. The Hynes method yielded an estimate 15.2 to 26.1% higher, or 33.3 g m^{-2}. Cohort turnover ratios for the first three methods ranged from 4.2 to 4.6 (not calculable for the Hynes method); the annual turnover ratio for the first three methods ranged from 5.8 to 6.3 and was 7.2 for the Hynes method. (Authors)

16886. Siefert, Richard E., William A. Spoor, and Roll F. Syrett (U. S. Environ. Protection Agency, Nat'l Water Qual. Lab., Duluth, Minnesota 55804). 1973. EFFECTS OF REDUCED OXYGEN CONCENTRATIONS ON NORTHERN PIKE (Esox lucius) EMBRYOS AND LARVAE. J. Fish. Res. Bd. Canada, 30(6): 849-852.

At 15 and 19 C, and at flows of 60 and 30 ml/min (velocities about 3.3 and 1.6 cm/min), 50% oxygen saturation was sufficient for survival and development of northern pike (Esox lucius) from fertilization until all surviving larvae fed. Oxygen tensions of about 33% saturation appeared inadequate for proper survival. (Authors)

16887. Nyman, Lennart. 1972. SOME EFFECTS OF TEMPERATURE ON EEL (Anguilla) BEHAVIOUR. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 90-102.

Irrespective of season of the year young yellow eels could be forced to perform a series of activity patterns when the water temperature was artificially manipulated. Besides changing preference for bottom substrate they displayed both crowding behaviour (at low temperatures) and intraspecific aggression (at high temperatures). Foraging was also initiated by a rise in temperature and a couple of degrees higher, when aggressive actions developed, a strong territorial behaviour became evident. Also, there was a discrepancy between small and larger yellow eels, larger specimens being less sensitive to temperature fluctuations. Some biological implications of these findings as well as the possible impact of thermal discharges to eel migrations are discussed. (Auth.'s summ.)

16888. Rio, G. J., F. J. Magnavita, J. A. Rubin, and William H. Beckert (Dept. of Biol., St. John's Univ., Jamaica, New York 11432). 1973. CHARACTERISTICS OF AN ESTABLISHED GOLDFISH Carassius auratus (L.) CELL LINE. J. Fish Biol., 5(3): 315-321.

A new continuous line of goldfish somatic cells designated SJU-1 has been continuously subcultured over a 39-month period. Best growth was obtained at 20°C over a pH range of 6.8-7.2. The minimal and optimal seed inocula, in terms of percent cell increase, were determined to be 1.1×10^6, and 2.5×10^6, respectively. The susceptibility of the SJU-1 line to infectious pancreatic necrosis virus offers an available assay system for goldfish in vivo and goldfish cells in vitro interferon studies. Chromosomal analyses of the line were also carried out. (Authors)

16889. Reeves, W. 1972. STRIPED BASS DISEASE PROBLEMS. Newsl. Southeast Coop. Fish. Dis., 9: 3.

Bacterial, Chondrococcus columnaris and Aeromonas sp., and parasitic, Glossetella sp., Scyphidia sp., and Trichodina sp., diseases and treatment are discussed.

16890. Wilamovski, A. (The Hebrew Univ., Dept. of Zool., Jerusalem, Israel). 1972. STRUCTURE OF THE GILL APPARATUS AND THE SUPRABRANCHIAL ORGAN OF Hypophthalmichthys molitrix Val (SILVER CARP). Bamidgeh, 24(4): 87-98.

The mouth and pharynx of Hypophthalmichthys molitrix (silver carp) are adjusted to feeding on plankton. Two nets, modifications of the gill rakers, project from each gill arch at an acute angle to each other to produce a canal. The pores in the nets are not greater than 20μ. The canals are attached to each other. A palatal fold fits into the distal edge of each canal, producing a filter system which closes the opening of the oesophagus. The gill arches are elongated so as to encircle the thick posterior of the palatal skin tissue from back to front. Each gill arch and its canal enters into a tube continuing into the palatal tissue block to form a hollow spiral suprabranchial organ around the muscle tissue. The suprabranchial organ, according to its structure, can be assumed to suck, by expansion, water into itself and accumulated food masses to the back and upper parts of the canals, then it pumps, by contraction, the water out, washing the food masses through the pores of the nets to the floor of the pharynx and the opening of the gullet. (Auth.)

16891. Yoshiyasu, Katsuhiko (Dept. of Otolaryngology, Fac. of Med., Osaka Univ., Osaka, Japan). 1973. STARCH-GEL ELECTROPHORESIS OF HEMOGLOBINS OF FRESHWATER SALMONID FISHES IN SOUTHWEST JAPAN - II. GENUS Oncorhynchus (SALMON). Bull. Jap. Soc. Sci. Fish., 39(1): 97-114.

The hemoglobins (Hb's) of the river and lacustrine forms of salmonid fishes such as "biwamasu", "amago", "yamame", etc., distributed in the southwestern part of Japan were analyzed electrophoretically by Smithies' starch-gel method. The fishes living in areas supposedly isolated for a long time showed a close uniformity in Hb pattern with few individual differences, while those living in areas where hybridization was suspected by reason of geography or the stocking of closely related fishes showed remarkable individual differences. There were some individuals with Hb components regarded as abnormal. The results obtained here seem not to conflict with the taxonomy previously proposed by the author on the basis of morphological and ecological observations. (Auth.)

16892. Kostenko, S. M. 1972. URCEOLARIIDAE, PARASITES OF FISH IN THE SOVIET SECTION OF THE DANUBE. Hydrobiological Journal, 8(3): 86-90.

Four hundred and seventy-five individual fishes (twenty-nine species) caught in different parts of the Lower Danube, in the Prorva, Belgorodskoye, Potapovo, and Bystroye estuaries, in the original bed of the Danube, and in the Ankundinovyye, Shabash, and Anan'kin bays were examined. Urceolariids were found on 110 specimens (fourteen species) or 23.1 percent of the number examined. Ten species and forms of the family Urceolariidae were identified in the material collected.

16893. Schulz, D. 1972. PROLIFERATIVE ENDOCARDITIS IN THE HEART OF CARP AFTER EXPOSURE TO THE HERBICIDE KARMEX. Zentralblatt für Veterinärmedizin A, 19, pp. 390-406; Weed Abstracts, 22(4): abstract 696, 1973.

Carp kept in tanks and exposed to Karmex (diuron 80%) for 40 days survived concentrations between 0.1 and 0.5 ppm but succumbed to 6 and 12 ppm. Postmortem examination of these and other carp from a Karmex-treated pond showed inflammation and degeneration of the liver, kidney and heart. Endocardial changes are illustrated and described in detail.

16894. Jessop, B. M. (Dept. of the Environ. of Canada, Resource Development Branch, Halifax, Nova Scotia, Canada). 1973. MARKING ALEWIFE FRY WITH BIOLOGICAL STAINS. Prog. Fish-Cult., 35(2): 90-93.

Bismark brown Y was found to be more suitable than neutral red for the immersion staining of young alewives (Alosa pseudoharengus). It was less toxic than neutral red and produced an identifiable mark for a longer time. Should the difficulties experienced in handling these fish be overcome, the marking method may be of practical use in population estimates. (Auth.)

16895. Kuo, Ching-Ming, Ziad H. Shehadeh, and Kathy K. Milisen (Oceanic Inst., Waimanalo, Hawaii 96795). 1973. A PRELIMINARY REPORT ON THE DEVELOPMENT, GROWTH AND SURVIVAL OF LABORATORY REARED LARVAE OF THE GREY MULLET, Mugil cephalus L. J. Fish Biol., 5(4): 459-470.

Larvae from artificially bred grey mullet were reared in the laboratory and survival rates of 0.2%, 5% and 5% achieved in three of six trials. Food consisted of wild zooplankton and Artemia nauplii. Feeding began on the fifth day, when the yolk sac was depleted, and intensified on the ninth day. The rate of yolk absorption and feeding intensity were reflected in the growth curve. Larval survival was not affected by withholding food from the larvae till the seventh day from hatching. Two critical periods associated with high larval mortality were apparent on the 2nd-3rd and 8th-11th days after hatching. These were preceded by an increase in specific gravity of larvae followed by passive sinking to the bottom of the rearing tank. Larval length increased from 2.63 mm at hatching to 17.69 mm at the end of the 42-day larval period. The larvae survived on benthic diatoms thereafter. Maximum survival rates were achieved at 22° C. (Authors)

16896. Smith, H. D. (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. OBSERVATIONS ON THE CESTODE Eubothrium salvelini IN JUVENILE SOCKEYE SALMON (Oncorhynchus nerka) AT BABINE LAKE, BRITISH COLUMBIA. J. Fish. Res. Bd. Canada, 30(7): 947-964.

Infection incidence among 15 brood years of smolts in the period 1952-71 was estimated from smolt and underyearling samples, and among late run fish from the main part of Babine Lake ranged from 6 to 45% (average 26%). In early run fish from the North Arm-Nilkitkwa area it ranged from 5 to 46% (average 22%) in 10 years during 1958-71. Infection intensity changed substantially during 1967; but about one fish in eight, or 200,000 individuals in the early run, carried parasite loads $\geq$ 10% of fish weight. Mature E. salvelini (Schrank 1790) averaged 32 mg in weight and 34 mm in length during a period of high incidence and intensity of infection in 1967. Although no proof was found of direct mortality caused by E. salvelini, indirect effects such as inferior growth, poor swimming performance, or aberrant behavior due to large cestode loads may increase host susceptibility to death from other causes. Changes in relative abundance of the zooplankton intermediate host, and midsummer shifts in feeding preferences of young sockeye likely account for increasing infection incidence in June and July, and stable incidence thereafter. (Auth.)

16897. Boyd, Claude E. (Dept. of Fish. & Allied Aquaculture, Auburn Univ. Agric. Exp. Sta., Auburn, Alabama 36830). 1973. THE CHEMICAL OXYGEN DEMAND OF WATERS AND BIOLOGICAL MATERIALS FROM PONDS. Trans. Amer. Fish. Soc., 102(3): 606-611.

The rate of oxygen consumption by organisms in pond waters, as measured by a dark bottle technique for a 24-hr period, increased with increasing chemical oxygen demand (COD). Rate of oxygen consumption increased with temperature between 15 and 35 C (Q_{10} values were 1.5 to 2.0). At the same level of COD, oxygen consumption was greater in unaltered pond water than in water in which the plankton was heat-killed and oxygen was utilized only by bacteria and other decomposers. COD was positively correlated with increasing concentrations of chlorophyll in pond waters. The amount of COD in soluble organic matter ranged from 20.2 to 95.0% of the total COD. The percentage of the COD in the soluble fraction decreased with increasing quantities of phytoplankton. The average amounts of oxygen (mg oxygen/mg dry wt) required to completely oxidize various types of biological material were: phytoplankton from pure cultures 1.29, macroscopic algae 1.00, higher aquatic plants 0.99, particulate matter from pond waters 0.98, and fish 1.19. (Auth.)

16898. Mayes, Monte A., and Grover C. Miller (Dept. of Zool., North Carolina State Univ., Raleigh, N. C.). 1973. A NEW GENUS AND THREE NEW SPECIES OF MONOGENETIC TREMATODES FROM NORTH CAROLINA CENTRARCHIDS, WITH A REDESCRIPTION OF Clavunculus okeechobiensis (Mizelle and Seamster) comb. n. Proc. Helm. Soc. Wash., 40(2): 186-191.

16899. Reed, Roger J., and James C. Moulton (Mass. Coop. Fish. Unit., Univ. of Mass., Amherst, Massachusetts). 1973. AGE AND GROWTH OF BLACKNOSE DACE, Rhinichthys atratulus AND LONGNOSE DACE, R. cataractae IN MASSACHUSETTS. Amer. Midl. Nat., 90(1): 206-210.

Age and growth of blacknose dace, Rhinichthys atratulus, and longnose dace, R. cataractae, are presented in the back-calculated and total length at capture format. The total length-scale radius relationships were: blacknose (Y = 10.665 + 0.7901 X) and longnose (Y = 19.598 + 0.8401 X). Growth rate of both species exceeded all published data. We documented two 5-year-old male longnose for the first time. Density levels are varied: blacknose dace (.003 - .094 per sq. ft.) and longnose dace (.003 - .083 per sq. ft.). (Authors)

16900. Nagayama, Fumio, Hiroshi Ohshima, Kazutami Umezawa, and Morikazu Kaiho (Tokyo Univ. of Fish., Konan 4, Minato-ku, Tokyo, Japan). 1972. EFFECT OF STARVATION ON THE ACTIVITIES OF GLUCOSE-6-PHOSPHATE METABOLIZING ENZYMES IN FISH. Bull. Jap. Soc. Sci. Fish., 38(6): 595-598. In Japanese with English abstract.

Activities of hepatic enzymes relating to glucose-6-phosphate metabolism of rainbow trout and eel were all depressed by starvation for 15 days. On the other hand, the depression effect of starvation on the activities of hexokinase, phosphoglucomutase and phosphoglucose isomerase of carp hepatopancreas was less than that on hepatic enzymes of rainbow trout and eel. Besides, the activities of glucose-6-phosphate dehydrogenase and glucose-6-phosphatase of carp were greatly elevated by starvation. From the fluctuation of enzyme activities during starvation, it was clear that the activities of glucose-6-phosphate metabolizing enzymes in carp hepatopancreas increase on starvation for 5-10 days, then decrease slowly, returning to almost normal level on starvation for 30 days.

16901. Zakharyan, G. B. (Azerbaydzhanian Dept., Central Sturgeon Fish. Res. Inst. (TsNIORKh) USSR). 1972. THE NATURAL REPRODUCTION OF STURGEONS IN THE KURA RIVER FOLLOWING ITS REGULATION. J. Ichthyol., 12(2): 249-259.

Detailed information is given on the location and extent of spawning grounds of sturgeons in the lower reaches of the Kura and Araks rivers. The influence of a number of hydrological factors on the reproductive biology of these fish is demonstrated. The approximate breeding periods of sturgeons are established.

16902. Colgan, Patrick, and David Ealey (Biol. Dept., Queen's Univ., Kingston, Ontario, Canada). 1973. ROLE OF WOODY DEBRIS IN NEST SITE SELECTION BY PUMPKINSEED SUNFISH, Lepomis gibbosus. J. Fish. Res. Bd. Canada, 30(6): 853-856.

Nesting preference for areas cleared of woody debris over areas cluttered with such debris was indicated by more nesting in cleared areas at the beginning and end of the breeding season, and more spawning activity in cleared areas. During heavy nesting, however, no preference was observed due to the density-dependent constraint of a high breeding population limiting available nesting apace. This lack of difference in nesting densities at peak times indicates that breeding density cannot be enhanced in pumpkinseed sunfish by the creation of additional environmental boundaries. Nest density was influenced by the type of substrate of the site. In cluttered sections, nest diameters and distances to nearest cover were less than, and nearest neighbor distances not significantly different from, those in cleared sections. (Authors)

16903. Khare, Anakshi, G. P. Moss, B. C. L. Weedon, and A. D. Matthews (Dept. of Chem., Queen Mary College, (Univ. of London) Mile End Road, London E1 4NS, England). 1973. IDENTIFICATION OF ASTAXANTHIN IN SCOTTISH SALMON. Comp. Biochem. Physiol., 45(4B): 971-973.

The identity of the pigment in the flesh of the Scottish salmon (Salmo salar) as astaxanthin has been confirmed. (Authors)

16904. Riley, J. D. (Fish. Lab., Lowestoft, Suffolk, England). 1973. MOVEMENTS OF 0-GROUP PLAICE Pleuronectes platessa L. AS SHOWN BY LATEX TAGGING. J. Fish Biol., 5(3): 323-343.

0-group plaice were caught in Red Wharf Bay, Anglesey, North Wales, tagged with colored liquid latex, and released in the bay or, after transplantation, at a position on a sandbank 3.5 km offshore. The pattern of movement shown by recaptures of plaice caught and released at the same position in the bay was one of extremely restricted movement of less than 0.5 km over several months, with only a slight interchange of fish between the sides of the bay and the centre. These restricted movements contrasted sharply with relatively long distances travelled by fish displaced to an unusual depth and position offshore and to a position at the other side of the bay 3 km away. In the first case a high proportion returned rapidly to the usual depth preference inshore and in the second a recapture pattern significantly different from that of control fish was demonstrated. Both results indicated a return to a preferred or familiar situation. (Auth.)

16905. Kuznetsov, V. A. (Dept. of Vertebrate Zool., Kazan' Univ., USSR). 1972. THE GROWTH PATTERN OF THE LARVAE AND YOUNG OF SOME FRESHWATER FISH AT DIFFERENT STAGES OF DEVELOPMENT. J. Ichthyol., 12(3): 433-442.

Five growth periods which are characterized by corresponding growth rate indices and which are related to the specific features of nutrition have been established on the basis of many years of observations on the growth of bream, roach, perch, pike-perch and pike larvae and young at different stages of development. In particular, it is noted that two critical periods are to be observed in the growth of cyprinid and percid larvae. The first is from the time of resorption of the yolk sac and transition to exogenous nutrition (from stanza B and C_1). The second is related to the transition from feeding on small zooplankton to crustacean zooplankton (stanzas D_1 and D_2). Larval growth rate declines at these periods. The second critical growth period is absent in the pike.

16906. Vorob'yev, V. I., V. F. Zaytsev, V. L. Karpenko, N. S. Samilkin, and N. V. Shkodin. 1972. TIME CHANGES IN CONCENTRATIONS OF TRACE ELEMENTS IN THE ORGANS AND TISSUES OF SOME COMMERCIAL FISHES OF THE VOLGA DELTA. Hydrobiological Journal, 8(4): 41-45.

Presents a study of the time changes in iron and copper concentrations in the organs and tissues of Abramis brama L. and Aspius aspius L. in relation to the season, species, and sex of the fish.

16907. Chu, Ar Jone, and Tasuku Hanaoka (Dept. Fish., Fac. Agr., Kyushu Univ., Hakozaki, Fukuoka, Japan). 1973. STUDIES ON OSMOTIC PRESSURE OF THE ENVIRONMENTAL MEDIA AND BODY FLUIDS OF MARINE FISH - II. CHANGES IN THE OSMOTIC PRESSURE OF BODY FLUID IN PELAGIC MARINE FISH RELATED TO THEIR MATURITY. Bull. Jap. Soc. Sci. Fish., 39(4): 349-355.

Observations were made on the temperature and chlorinity of the sea water, in which shoals of mackerel Scomber japonicus and Jack mackerel Trachurus japonicus were found. The freezing-point depression of the sera and the state of maturity in these species were also examined monthly for two years in the fishing grounds of the East China Sea. In the course of migration, the osmotic pressure of body fluids rose significantly as the maturity of the fish progressed, showing a maximal value averaging 12 Atms. at the time of spawning. This value remained unchanged until the ripe eggs had been completely disappeared from the ovaries, but then dropped gradually to 6 Atms. The osmotic pressure of the environmental sea water also varied to a certain extent (no more than 5%) corresponding to the change of that of body fluids. The difference between both osmotic pressures was reduced owing to a great increase in serum osmolality. The least difference occurred at spawning times. After spawning, however, the fish moved into waters of a constant osmotic pressure. They therefore migrated towards waters of higher chlorinity when the water temperature grew colder in the winter time. Hence, the difference between the osmotic pressures of the body fluid and the sea water returned to the original state.

16908. Chao, Labbish Ning (Va. Inst. of Marine Sci., Gloucester Point, Virginia 23062). 1973. DIGESTIVE SYSTEM AND FEEDING HABITS OF THE CUNNER, Tautogolabrus adspersus, A STOMACHLESS FISH. NOAA Fish. Bull., 71(2): 565-586, illus.

The cunner, Tautogolabrus adspersus, completely lacks a morphologically or physiologically distinct stomach. The alimentary tract consists of the pharynx followed by a short esophagus with an esophageal-intestinal valve at the junction of esophagus and intestine. The intestine has three limbs and an S-loop. The intestinal bulb where the bile duct enters is present at the anterior end of the first limb. The border between the posterior end of S-loop and the rectum is marked by the intestinal-rectal valve. Histological and histochemical observations indicate that the rodlet cells, wandering cells, longitudinal muscle layers, and the rectal valve differ in minor ways from those of other stomachless fishes. Different forms of rodlet cells are found in the bile duct. An alkaline condition (pH values between 7.0 and 8.5) prevails throughout the alimentary tract. Alkaline phosphatase reaction was demonstrated only when food was present in the gut. Cunner are carnivorous, and the feeding habits change with growth. Juveniles feed mainly on planktonic crustacea and adults on sessile animals (mussels and barnacles). The time between ingestion and defecation of mussels (Mytilidae) by cunner is 10 to 14 hr. Intact mussels can pass through the alimentary tract of the fish undamaged and alive. (Auth.)

16909. Hall, S. J., E. E. Evans, Harry K. Dupree, Ronald T. Acton, Peter F. Weinheimer, and J. Claude Bennett (Univ. of Alabama, Birmingham, Alabama 35294). 1973. CHARACTERIZATION OF A TELEOST IMMUNOGLOBULIN: THE IMMUNE MACROGLOBULIN FROM THE CHANNEL CATFISH, Ictalurus punctatus. Comp. Biochem. Physiol., 46(1B): 187-197.

The channel catfish, Ictalurus punctatus, was immunized with 2,4-dinitrophenol-protein conjugates and found to produce two different molecular weight species of antibodies when tested with DNP coupled to human erythrocytes. The higher molecular weight antibody was isolated and found to have a molecular weight of 610,000 with a sedimentation coefficient of 14 S. The carbohydrate composition differed from that of human macroglobulins, having a mannose-galactose ratio of approximately one and a total carbohydrate content of 5.5%. Complete reduction and alkylation of this macroglobulin, followed by gel filtration in 5 M guanidine hydrochloride, resulted in the separation of the heavy (H) and light (L) polypeptide chains. These chains had molecular weights of 58,000 $\pm$ 2500 and 22,500 $\pm$ 2500, respectively, as determined by column chromatography. These data are most consistent with a tetrameric macroglobulin molecule. (Authors)

16910. Nyman, Lennart. 1972. A NEW APPROACH TO THE TAXONOMY OF THE "Salvelinus alpinus SPECIES COMPLEX". Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 103-131.

Gene frequency data of an esterase polymorphism in Arctic char (Salvelinus alpinus (L.)) were analysed in 31 populations of landlocked and anadromous char from North America, Greenland and Scandinavia. Also, two specimens of Dolly Varden char (Salvelinus malma (Walbaum)) were analysed electrophretically. On the basis of gene frequency distributions correlated with ecological parameters three sibling species of char within the so called Salvelinus alpinus complex could be distinguished in the Scandinavian samples. One of these species, the normal char, appears conspecific with the normal char of North America and Greenland, whereas the other form studied from this region - the Dolly Varden - is considered a distinct species. The variability of sympatric chars is believed to have resulted from introgression in recent times after the ancestral species had evolved their reproductive isolating mechanisms allopatrically. (Auth.'s summ.)

16911. Schachte, J. 1972. BACTERIA DESTROYS CATFISH EGGS. Newsletter Southeast Coop. Fish Disease Project, 9: 1-2.

In a two year study of mortalities in commercial channel catfish eggs, two genera, Flavobacterium and Acinetobacter, have been isolated and identified.

16912. Falkner, N. W., and J. G. Eales (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1973. INVESTIGATION OF IODOTHYRONINE BINDING TO PLASMA PROTEINS IN BROOK TROUT, Salvelinus fontinalis, USING PRECIPITATION, DIALYSIS, AND ELECTROPHORETIC METHODS. J. Fish. Res. Bd Canada, 30(8): 1131-1140.

Over 95% of 3, 5, 3'-triiodo-L-thyronine (T_3) or L-thyroxine (T_4) up to added hormone levels of at least 5 μg/ml, were precipitated by trichloroacetic acid with plasma proteins of brook trout using a semimicro method. Hormone recovery in the precipitate was higher than with precipitation methods previously used on fish plasma. Equilibrium dialysis showed over 99% of T_4 or T_3 bound to plasma proteins of trout up to added hormone levels of at least 5 μg/ml. Acrylamide gel was superior to paper and particularly cellulose polyacetate as a medium for electrophoretic separation of proteins responsible for binding T_3 or T_4. In vitro studies at high hormone levels showed that T_3 and T_4 bound mainly to prealbumin-like proteins. In vivo studies at more physiological levels showed T_4 bound to fast prealbumin-like, albumin-like, and β-globulin-like proteins, while T_3 bound to slow prealbumin-like and probably the same albumin-like and β-globulin-like proteins as T_4. (Authors)

16913. Kucherova, F. N. (Lab. of Embryol. and Histol., Fac. of Human and Animal Physiol., Rostov-on-Don Univ., USSR). 1972. CATION COMPOSITION OF THE SPERM CELLS AND SEMINAL FLUID OF Vimba vimba (L.). J. Ichthyol., 12(4):666-670.

The following elements were detected in an ash residue of the sperm cells of Vimba vimba (L.) by microanalytical techniques based on crystal optics and the use of the spot test method: potassium, sodium, magnesium, lithium, caesium, calcium, strontium, aluminum, chromium, beryllium, titanium, niobium, lanthanum, manganese, zinc, iron, cobalt, nickel, indium, silver, vanadium, mercury, lead, thallium, copper, cadmium, bismuth, palladium, antimony, tin, molybdenum, selenium, tellurium, platinum, iridium, and rhenium. The elements detected in an ash residue of the seminal fluid were potassium, sodium, ammonia, magnesium, lithium, rubidium, caesium, calcium, strontium, barium, aluminum, chromium, beryllium, titanium, zirconium, thorium, lanthanum, tantalum, manganese, zinc, iron, cobalt, nickel, silver, mercury, lead, copper, cadmium, bismuth, ruthenium, palladium, arsenic, antimony, tin, molybdenum, tellurium, platinum, iridium and rhenium. Consideration is given to the role of the cations of the seminal fluid in neutralization of the acid products of the ovulated ovum at the time of insemination and in the intensification of some of the metabolic reactions occurring before the spermatozoa are already at its surface. (Auth.)

16914. Sano, Tokuo (Tokyo Univ. of Fish., 4-5-7 chome, Konan Minato-ku, Tokyo, Japan). 1973. STUDIES ON VIRAL DISEASES OF JAPANESE FISHES - IV. INFECTIOUS PANCREATIC NECROSIS OF RAINBOW TROUT: SUSCEPTIBILITY OF FRESH WATER SALMONS OF GENUS Oncorhynchus. Bull. Jap. Soc. Sci. Fish., 39(2): 117-120. In English.

IPN virus, isolated from diseased fish at the Tokyo Municipal Trout Hatchery, was used for infectivity trials with three different salmonids. Infectivity tests showed that IPN virus was pathogenic not only to the fry of rainbow trout but also to the fry of Amago and Himemasu, and not pathogenic to the fry of Yamame. Therefore, Amago and Himemasu can possibly be carrier hosts of IPN virus.

16915. Smith, Jim Ross (NMFS, Northwest Fish. Center, Seattle, Washington 98112). 1973. BRANDING CHINOOK, COHO, and SOCKEYE SALMON FRY WITH HOT AND COLD METAL TOOLS. Prog. Fish-Cult., 35(2): 94-96.

One hot and two cold branding techniques were tested on chinook, coho, and sockeye salmon fry. These tests were made at the National Marine Fisheries Service, Northwest Fisheries Center in Seattle, Wash. All produced satisfactory short-term marks without excessive mortality. (Auth.)

16916. Berdyshev, G. D., and N. A. Protsenko. 1972. CURRENT THEORIES ON THE MECHANISMS OF THE POSTSPAWNING DEATH OF PACIFIC SALMON. Hydrobiological Journal, 8(4): 85-93.

This survey of present-day thinking on the postspawning death of Far Eastern salmon embraces published morphological, physiological, and biochemical studies, as well as the results of personal observations on the humpback salmon (Oncorhynchus gorbuscha Walb.).

16917. Harris, J. E., Aileen Watson, and S. Hunt (Dept. of Biol. Sciences, Univ. of Lancaster, Bailrigg, Lancaster, England). 1973. HISTOCHEMICAL ANALYSIS OF MUCOUS CELLS IN THE EPIDERMIS OF BROWN TROUT Salmo trutta L. J. Fish Biol., 5(3): 345-351.

A histochemical study of the epidermal mucous cells of brown trout revealed that they contained both neutral and acidic mucosubstances which were diastase-resistant, PAS-reactive. Neuraminidase treatment, methylation and combined staining procedures suggested that the acidic nature of the mucins was due mainly to the presence of sialic-acid containing glycoprotein. These results augment data derived from biochemical analyses of the epidermal mucus of salmonid fish. (Authors)

16918. Winters, G. H., J. A. Moores, and R. Chaulk (Fish. Res. Bd. of Canada, Biol. Sta., St. John's, Newfoundland, Canada). 1973. NORTHERN RANGE EXTENSION AND PROBABLE SPAWNING OF GASPEREAU (Alosa pseudoharengus) IN THE NEWFOUNDLAND AREA. J. Fish. Res. Bd. Canada, 30(6): 860-861.

A single specimen of gaspereau, Alosa pseudoharengus (Wilson 1811), was taken near Paquet in northeastern Newfoundland. This is the first record of gaspereau from eastern Newfoundland and extends the northern range of the species in the western Atlantic. Spawning of gaspereau in Newfoundland rivers is also indicated. (Authors)

16919. Matsui, Masami, Takeshi Watanabe, and Nobuo Ikekawa (Tokyo Res. Lab., Shimadzu Seisakusho Co., Ltd., Chofu-shi, Tokyo, Japan). 1973. EFFECT OF α-TOCOPHEROL DEFICIENCY ON CARP - III. ANALYTICAL METHOD FOR TRIGLYCERIDE COMPOSITION OF FISH LIPID. Bull. Jap. Soc. Sci. Fish., 39(4): 367-373. In English.

Quantitative and qualitative gas chromatography of triglycerides has been extended to fish lipids containing both odd and even carbon number fatty acids. A 50 cm short glass column containing 2% OV-17 on 80/100 mesh Shimalite W gave good resolution of triglyceride peaks at a higher temperature, 280°-340°C. Qualitative analysis was found to be possible by using calibration factors determined by the internal normalization technique. The triglycerides of two fish oils (carp and rainbow trout), soybean oil and cod liver oil were analysed by this method. This method was also useful for determining the triglyceride compositions of other fish oils. (Authors)

16920. Hyvarinen, H., and T. Valtonen (Dept. of Zool., Univ. of Oulu, Finland). 1973. SEASONAL CHANGES IN THE LIVER MINERAL CONTENT OF Coregonus nasus (Pallas), sensu Svärdson, IN THE BAY OF BOTHNIA. Comp. Biochem. Physiol., 45(4B): 875-881.

A clear seasonal variation was found in the copper content of the liver of Coregonus nasus (Pallas), sensu Svärdson, but was not a sex-dependent variation. In calcium and magnesium content both a seasonal and a sex-dependent variation were found. No seasonal or sex-dependent variation occurred in the zinc content. The results suggest that the changes in the liver mineral contents cannot be connected with feeding intensity. It is assumed that the changes are partly connected with changes in the metal constituents of the metal enzyme complexes or with changes in the metalloenzyme concentrations. (Authors)

16921. Heckmann, Richard, and David G. Farley (Dept. of Biol., Calif. State Univ., Fresno, California). 1973. ECTOPARASITES OF THE WESTERN ROACH FROM TWO FOOTHILL STREAMS. J. Wildl. Disease, 9(3): 221-224.

16922. Anctil, Michel, M. A. Ali, and Pierre Couillard (Dept. des Sci. Biol., Fac. des Sci., Univ. de Montreal, Montreal, Canada). 1973. ISOLATED RETINAL CELLS OF SOME LOWER VERTEBRATES. Revue Canadienne de Biologie, 32(2): 107-119.

A technique for the isolation of intact retinal cells by enzymatic (pronase) treatment has been developed using the retinas of fish (bowfin and goldfish) and frog (leopard frog and bullfrog). Secondarily, a crude isolation method was also tested with retinas of the brook trout and yellowperch. The various retinal cell types thus obtained (mainly photoreceptors) are characterized morphologically for each animal treated. Special emphasis is given to the accessory outer segment, the myoid and the synaptic piece of the photoreceptors, all those organelles acquiring a fresh outlook when viewed in the living state. The accessory outer segment and the myoid are discussed as possible factors in the retinomotor mechanism, while older views and terminologies regarding the synaptic pieces (rod and cone pedicles) are revised in the light of new observations. Possible applications of these techniques to physiological and cytochemical studies of retinal cells are suggested. (Authors)

16923. Zolotova, Z. K. 1970. BIOLOGICAL WEED CONTROL IN IRRIGATION CANALS WITH THE AID OF GRASS CARP. Sbornik nauchno-issledovatel'skikh Rabot, Vsesoyuznyi nauchno-issledovatel'skii Inst. Prudovogo Rybnogo Khozyaĭstva, (4): pp. 112-126; Weed Abstracts, 21(6): Abstract No. 3018.

In June 1964, yearling grass carp weighing 47 g each were stocked at 5400 fish (254 kg)/ha in a 0.4-ha area of canal in the Chibiĭsk irrigation system in Krasnodar District. In June, Phragmites and Typha spp. with a well-defined understorey of reedgrass (Glyceria maxima) and stream-bank sedge (Carex riparia) infested 46% of the stocked area. At the end of the experiment (25 August), infestation of macrophytes had been reduced by 2/3 mainly at the expense of G. maxima, cut-grass (Leersia oryzoides), beckmannia (Beckmannia eruciformis) and C. riparia. The area infested by soft vegetation was reduced to only 1%; Lemna minor and Salvinia natans were quickly consumed. Reed mace (Typha latifolia) which weighed 5.5 kg/m^2 in June was eliminated by the end of August. Although established reeds and T. angustifolia were too fibrous for the palate of 1-year-old fish, new shoots were eaten as they emerged from rhizomes and the spread of infestation was arrested. The total vegetative production of the test area was reduced from 92.6 hkg in June to 14.9 hkg in August. The fish had consumed at least 63 hkg of vegetation giving a feeding quotient (conversion ratio) of 32. When preferred plants were all consumed, grass carp fed on decomposing stalks of T. latifolia, rhizomes of P. communis, seeds of Typha spp. and roots of bank plants. Grass carp stocked at 254 kg/ha had consumed 157 hkg of palatable food/ha within 2 months.

16924. Korovina, V. M., G. A. Golovkov, L. I. Lebedeva, and V. P. Prirodina (Ichthyol. Lab., Zool. Inst., USSR Acad. of Sciences and Piscicultural Lab., State Res. Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, USSR). MORPHOLOGICAL CHARACTERISTICS OF BROAD WHITEFISH X PELYAD (Coregonus nasus [Pallas] X C. peled [Gmelin]) RECIPROCAL HYBRIDS. COMMUNICATION 1. J. Ichthyol., 12(3): 443-456.

Fully viable broad whitefish X pelyad reciprocal hybrids were experimentally obtained. The manifestation of a number of morphological characters in individuals of the first generation has been studied. Intermediate manifestation with some deviation either toward one of the species or toward the maternal side is typical for many characters. The distinctive mouth parts and gill apparatus are responsible for different feeding of the hybrids by comparison with the parental species.

16925. Florez, Fabio (Dept. of Animal Ecology, Univ. of Lund, Sweden). 1972. THE EFFECT OF TEMPERATURE ON INCUBATION TIME, GROWTH AND LETHALITY OF EMBRYOS, LARVAE AND JUVENILES OF THE IDE, Idus idus (L.). Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 50-64.

16926. Sivak, Jacob G. (Div. of Biol. Sciences, Cornell Univ., Ithaca, New York). 1973. INTERRELATION OF FEEDING BEHAVIOR AND ACCOMODATIVE LENS MOVEMENTS IN SOME SPECIES OF NORTH AMERICAN FRESHWATER FISHES. J. Fish. Res. Bd. Canada, 30(8): 1141-1146.

Accommodation, in response to atropine and pilocarpine, was measured retinoscopically and photographically in seven species of freshwater fishes. These species accommodate in varying magnitudes and directions by means of lenticular movements. The common white sucker (Catostomus commersoni) and the goldfish (Carassius auratus) accommodate mainly in the lateral direction (5-10 diopters), whereas the common bluegill (Lepomis macrochirus), northern rock bass (Ambloplites rupestris), and yellow perch (Perca flavescens), exhibit a larger accommodative ability which occurs primarily along the rostral-caudal axis (up to 40 diopters in the yellow perch). The rainbow trout (Salmo gairdneri) accommodates equally along the lateral and rostral-caudal axes. No accommodative response occurs in the northern black bullhead (Ictalurus melas). Reference to the diets and feeding habits of the above species suggests that the magnitude and principal direction of accommodation is a response to the visual demands of a particular life history. (Auth.)

16927. Hines, Ron S., and Dan T. Spira (Agric. Res. Organization, Fish and Aquaculture Sta, Dor, Israel). 1973. Ichthyophthirius multifiliis (Fouquet) IN THE MIRROR CARP, Cyprinus carpio L. J. Fish Biol., 5(3): 385-392.

Mirror carp were infected with Ichthyophthirius multifiliis (Fouquet) under standardized conditions. The size and number of parasites at selected sites on the body were recorded during the course of the infection. Initial exposure to 40 mature parasites resulted in a mild infection with 100% recovery after 18 days. Recovered fish did not appear to be carriers of the parasite. Exposure to 400 parasites resulted in 100% mortality between 22-25 days. The growth rate of the parasite was linear. Parasites were more numerous in the dorsal surface of the fish than in the lateral or ventral surface. The increase in parasite numbers during the disease was greater in the gills than in the skin. (Authors)

16928. Endo, Toshio, Kenji Ogishima, Haruo Hayasaka, Shuji Kaneko, and Satoshi Ohshima (Biol. Res. Lab., Tanabe Seiyaku Co., Ltd., Saitama, Japan). 1973. APPLICATION OF OXOLINIC ACID AS A CHEMOTHERAPEUTIC AGENT AGAINST INFECTIOUS DISEASES IN FISHES - I. ANTIBACTERIAL ACTIVITY, CHEMOTHERAPEUTIC EFFECTS AND PHARMACOKINETICS OF OXOLINIC ACID IN FISHES. Bull. Jap. Soc. Sci. Fish., 39(2): 165-171. In Japanese with English abstract.

Oxolinic acid (1-ethyl-1, 4-dihydro-6, 7-methylenedioxy-4-oxo-3-quinolinecarboxylic acid) has been known to possess an antibacterial activity against gram-negative bacteria (Aerobacter, Brucella, Pasteurella, etc.) and chemotherapeutic effects on infected animals. We also found that this compound had a superior antibacterial activity against several bacteria (Aeromonas, Vibrio, and Chondrococcus) isolated from diseased fishes, and that it was also active against Aeromonas liquefaciens (R^+). Oxolinic acid exhibited a chemotherapeutic effect on carps infected with Aeromonas liquefaciens when it was orally administered (3 mg/kg, once a day for 5 days) or when the fishes were bathed in medicated water (1 mcg/ml, for 24 hours). The bathing method was also effective in loaches infected with Chondrococcus columnaris. Single oral doses of 40, 20, 10, and 5 mg/kg in carps resulted in peak serum levels of 2.23 (15 hours after administration), 0.89 (24 hours after administration), 0.59 (24 hours after administration), and 0.73 mcg/ml (24 hours after administration). Oral acute toxicity (LD_{50}) was over 4,000 mg/kg in carp.

16929. Sears, H. S., and W. R. Meehan (NMFS, Biol. Lab., Auke Bay, Alaska 99821). 1971. SHORT-TERM EFFECTS OF 2,4-D ON AQUATIC ORGANISMS IN THE NAKWASINA RIVER WATERSHED, SOUTHEASTERN ALASKA. Pesticides Monitoring Journal, 5(2): 213-217; Weed Abstracts, 21(5): Abstr. No. 2612.

About 400 ac of cut-over land were treated with 2,4-D to inhibit the growth of broad-leaved plants. No immediate mortality to salmonid fishes or aquatic invertebrates was attributable to the spray. Samples of water and fish had concns. of 2,4-D well below the level generally considered to be lethal to aquatic organisms.

16930. Mezhnin, F. I. (Lab. of the Physiol. of Lower Organisms, Inst. of the Biol. of Inland Waters, USSR Acad. of Sci., Borok, Yaroslavl' Province, USSR). 1972. INTERRENAL AND CHROMAFFIN TISSUE OF FRESHWATER FISH. J. Ichthyol., 12(4): 671-684.

Investigations were made of the topography and histological structure of interrenal and chromaffin tissue of freshwater fish (19 species drawn from 6 families). General histological and histochemical methods were used. It is shown that there are 4 types of arrangement of the interrenal tissue in fish and 5 types of arrangement of chromaffin tissue. Marked differences have also been discovered in the topography and histological structure of these tissues not only in members of different families, but also in different species of the same family. Large variations have also been noted in the histological structure of the pronephros in the species investigated.

16931. Weisel, G. F., D. A. Hanzel, and R. L. Newell (Zool. Dept., Univ. of Montana, Missoula, Montana 59801). 1973. THE PYGMY WHITEFISH, Prosopium coulteri, IN WESTERN MONTANA. NOAA Fish. Bull., 71(2): 587-596.

The pygmy whitefish, Prosopium coulteri, is a glacial relict which has been considered to be the most primitive of coregonines. It is relatively abundant in lakes of western Montana and is undoubtedly an important source of food for Dolly Varden and lake trout. Compared to other members of its subfamily, it is characterized by low meristic counts. These counts differ somewhat in populations from Montana, Alaska, and Lake Superior. Major food items consumed by the pygmy whitefish shift with availability but the main reliance is on cladocera and chironomid larvae and pupae. The annual growth in Flathead Lake, Montana, is greater than that in Lake Superior but below that in some Alaskan lakes. No males were found older than age III and no females beyond age IV. Many of the males mature at age I, a year earlier than most females. The spawning season is in December and January when the fish move into tributary streams. The species spawns in successive years. The fecundity of the Montana fish is similar to that of pygmy whitefish from other areas. The pygmy whitefish successfully competes with other coregonines in reproduction by spawning at a later date and earlier age, and by having smaller eggs which yield more eggs per unit weight of fish. The small size and early age at maturity are considered adaptations developed for survival in cold and nutrient-poor water during glaciation. (Authors)

16932. de Kinkelin, P., and M. Dorson (Inst. Nat'l Recherche Agronomique, Sta. Recherches Virol. et d'Immunol., Lab. d'Ichthyopathologie, Thiverval-Grignon, France). 1973. INTERFERON PRODUCTION IN RAINBOW TROUT (Salmo gairdneri) EXPERIMENTALLY INFECTED WITH EGTVED VIRUS. J. gen Virol., No. 19, pp. 125-127; Fish Health News, 2(3): p. 9.

The study was conducted to investigate interferon synthesis in vivo. Live Egtved virus was injected intraperitoneally into 80 gm rainbow trout which were held for 2 weeks at 15° C to inhibit or to prevent disease. Serum interferon activity was assayed in RTG-2 cells at 3, 9, and 14 days post-injection. Egtved, IPN, and IHN viruses were employed in the assays. Results clearly showed peak activity at 3 days (a mean of 1479 Interferon Units), less at 9 days (a mean of 112 I. U.) and least at 14 days (a mean of 2.5 I. U.). Based upon heat, pH, and RNAse stability, lability to trypsin, and the fact that homologous RTG-2 cells were protected to the extent of 15 times greater than heterologous FHM cells, the activity was assigned to in vivo production of interferon. -- Ken Wolf

16933. Ritter, John A. (Dept. of the Environ. of Canada, Fish. Serv., Resource Develop. Branch, Halifax, Nova Scotia, Canada). 1973. COSTS OF TAGGING HATCHERY-REARED ATLANTIC SALMON SMOLTS WITH MODIFIED CARLIN-TYPE TAGS. Prog. Fish-Cult., 35(2): 118-119.

Tagging costs were determined for smolt marking programs carried out in the spring of 1971 at 5 stations in New Brunswick and Nova Scotia. Cost per unit smolt tagged was $0.193. Materials and labor (6-man crew) accounted for $0.082 and $0.083 per smolt tagged, while technical supervision cost an additional $0.028 per smolt. (Auth.)

16934. Frame, David W. (NMFS, Atlantic Estuarine Fish. Res. Center, Beaufort, North Carolina 28516). 1973. CONVERSION EFFICIENCY AND SURVIVAL OF YOUNG WINTER FLOUNDER (Pseudopleuronectes americanus) UNDER EXPERIMENTAL CONDITIONS. Trans. Amer. Fish. Soc., 102(3): 614-617.

Age I winter flounder, Pseudopleuronectes americanus, weighing 40-100 g were fed chopped bivalve siphons (Mya arenaria) ad libitum. Sixteen fish were held at 4 temperatures (12, 16, 20 and 24 C) and two salinities (20 and 30 °/oo), with two fish per regime. Only 4 fish held at 12 C and 16 C in 20 °/oo salinity had a normal growth rate, and the conversion efficiency for these fish ranged from 13.9-19.0%. (Auth.)

16935. Zaugg, W. S., and H. H. Wagner (Western Fish Nutr. Lab., Bur. of Sport Fish. & Wildl., Cook, Washington 98605). 1973. GILL ATPASE ACTIVITY RELATED TO PARR-SMOLT TRANSFORMATION AND MIGRATION IN STEELHEAD TROUT (Salmo gairdneri): INFLUENCE OF PHOTOPERIOD AND TEMPERATURE. Comp. Biochem. Physiol., 45(4B): 955-965.

Photoperiod schedules were used to control the onset of parr-smolt transformation in steelhead trout (Salmo gairdneri). Gill Na^+, K^+-stimulated ATPase activity was elevated in smolts exhibiting migratory behavior. ATPase activity was decreased and migration reduced when animals were subjected to temperatures of about 13°C or greater, or when the length of increasing photoperiods approximated that of the summer solstice (22 June). (Authors)

16936. Stenson, Jan A. E. (Dept. of Zool., Univ. of Gothenburg, Sweden). 1972. FISH PREDATION EFFECTS ON THE SPECIES COMPOSITION OF THE ZOOPLANKTON COMMUNITY IN EIGHT SMALL FOREST LAKES. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 132-148.

The crustacean plankton fauna of 8 small forest lakes in the province of Bohuslän, S. W. Sweden, were investigated, especially with regard to effects of size-dependent predation. Four of the lakes were treated with rotenone. Three of these lakes were restocked with new fish species, the fourth having been reoccupied by the original species. The physico-chemical limnology conditions in the lakes showed great similarities throughout the year and the differences in the sediment composition and vegetation were very small. The lake treated with rotenone but containing the original fish fauna had exactly the same zooplankton species composition as the untreated lakes. In the lakes with low predation intensity (i.e. those with the new fish species) the larger zooplankton species Bythotrephes longimanus and Daphnia longispina were present. These species were eliminated in the lakes with high predation intensity and D. longispina was here replaced by the smaller species D. cristata. A clear difference, in the size distribution of the cladoceran community, between the lakes with high predation intensity (those with the original fish species) and the lakes with low predation intensity (those with the new fish species) is demonstrated. The larger Bosmina coregoni replaced the smaller B. longirostris when the predation intensity decreased. (Auth.'s summ.)

16937. Watanabe, Takeshi, Masami Matsui, Fumio Takashima, and Nobuo Ikekawa (Tokyo Univ. of Fish., Konan, Minato-ku, Tokyo, Japan). 1973. EFFECT OF α-TOCOPHEROL DEFICIENCY ON CARP - IV. THE COMPOSITION OF TRIGLYCERIDES. Bull. Jap. Soc. Sci. Fish., 39(4): 375-382. In English.

The triglyceride composition of carp fed an α-tocopherol deficient diet was determined directly by gas chromatography. Rainbow trout fed a vitamin E-free diet were also analysed in a limited comparison study. Carp muscle lipids showed triglyceride distribution from C-43 to C-56 and the dominant components in the control were C-50 to C-54 triglycerides, whereas those of the experimental group were the C-43 and C-45 triglycerides. Furthermore, in the deficient carp, linoleic acid was absent in the muscle lipid. No significant difference between the control and experimental groups was observed in the triglyceride composition of rainbow trout. (Authors)

16938. Coutant, Charles C. (Ecosystems Dept., Battelle Mem. Inst., Pacific Northwest Labs, Richland, Washington 99352). 1973. EFFECT OF THERMAL SHOCK ON VULNERABILITY OF JUVENILE SALMONIDS TO PREDATION. J. Fish. Res. Bd. Canada, 30(7): 965-973.

Thermally shocked juvenile rainbow trout and chinook salmon were selectively preyed upon by larger trout in the laboratory when exposure times to elevated temperatures exceeded a minimum duration. This duration was 10% (chinook) and 20% (rainbow) of the exposure duration that caused obvious loss of equilibrium (complete body inversion) of half a test population at that temperature. Longer exposures increased vulnerability to predation relative to controls almost exponentially. Shorter exposures made shocked fish less susceptible to predation. Shocked fish showed some recovery from heat effects when returned to the initial holding temperature for 1/2 or 1 hr prior to predation. Susceptibility of rainbows to predation (relative to controls) appears to follow the time- and temperature-dependent response pattern previously shown by others for death and visible equilibrium loss. Selective predation began at exposures about 10% of the median death time in the range 26 to 30 C. (Auth.)

16939. Shehadeh, Ziad H., Ching-Ming Kuo, and Kathy K. Milisen (Oceanic Inst., Waimanalo, Hawaii 96795). 1973. INDUCED SPAWNING OF GREY MULLET Mugil cephalus L. WITH FRACTIONATED SALMON PITUITARY EXTRACT. J. Fish Biol., 5(4): 471-478.

The efficacy of fractionated salmon pituitary gonadotropin as a spawning agent in Mugil cephalus L. was tested. Natural spawning was induced in all females with a total dose of 11.9-20.9 μg/g body wt. Spawning dose varied inversely with initial mean egg diameters of recipient females. A 'critical' mean egg diameter of 650-700 μ was observed to precede the hormone dose that induced spawning. A 'priming' effect was observed following the initial injection and is discussed. The 'latency period' was determined to be 10-15 h; fecundity was estimated at 648 eggs/g body wt. Courtship, spawning and fertilization occurred naturally with uninjected males. (Authors)

16940. Belyy, N. D. (Deceased) (Inst. of Hydrobiol., Ukrainian Acad. of Sciences, Kiev, USSR). 1972. DOWNSTREAM MIGRATION OF THE PIKE-PERCH Lucioperca lucioperca (L.) AND ITS FOOD IN THE EARLY DEVELOPMENT STAGES IN THE LOWER REACHES OF THE DNIEPER. J. Ichthyol., 12(3):465-472.

The most intensive downstream migration of free-swimming pike-perch larvae is observed immediately after their hatching. The quantitative indicators of downstream migration are reduced as the larvae grow. The downstream migration of pike-perch larvae is not caused by directed movement, but results from the action of the current. Exogenous nutrition is observed in the larvae when they still have an oil droplet. They feed initially on rotifers and subsequently on larger organisms. The pike-perch becomes predatory at a length of 12-15 mm.

16941. Numachi, Ken-ichi, Yoshiharu Matsumiya, and Ryozo Sato (Ocean Res. Inst., Univ. of Tokyo, Nakano, Tokyo 164, Japan). 1972. DUPLICATE GENETIC LOCI AND VARIANT FORMS OF MALATE DEHYDROGENASE IN CHUM SALMON AND RAINBOW TROUT. Bull. Jap. Soc. Sci. Fish., 38(7): 699-706. In English.

Supernatant malate dehydrogenase (S-MDH) isozymes of chum salmon and rainbow trout were examined by starch gel electrophoresis. Three types of B-subunit isozyme patterns were demonstrated for 396 specimens of chum salmon captured in nine rivers, and four types for 420 of rainbow trout from six hatcheries. On the bases of the occurrence of three isozymes at distinctly asymmetrical ratios in heterozygote variants and the frequencies of phenotypes in the populations examined, it was suggested that each of these two species possesses duplicate genetic loci producing dimeric isozymes, which are composed of subunits B' and B in rainbow trout, and B and B'' in chum salmon, under the control of corresponding alleles. The gene frequencies of B allele in the rainbow trout populations and the frequency of B'' allele in the chum salmon populations were respectively .103 and .056 at most: 65 to 95 percent of rainbow trout exhibited a single isozyme consisting of B' subunit, and

more than 82 percent of chum salmon exhibited one consisting of B subunit. The demonstration of duplicate loci for B-subunit isozyme of S-MDH in both species provides additional support for the tetraploidy hypothesis of salmonids.

16942. Mathis, B. J., and T. F. Cummings (Dept. of Biol., Bradley Univ., Peoria, Illinois). 1973. SELECTED METALS IN SEDIMENTS, WATER, AND BIOTA IN THE ILLINOIS RIVER. J. Water Pollution Control Federation, 45(7): 1573-1583.

This study was designed to assess the degree of metal contamination in a large midwestern river. The river is utilized both by industries for manufacturing and waste disposal purposes and by cities as a source of potable water and a means of wastewater disposal. Analyses were made for copper, nickel, lead, chromium, lithium, zinc, cobalt, and cadmium in bottom sediments, water, tubificid annelids, clams and fishes. Metal concentrations were higher in sediments than in water and organisms. Clams and worms that inhabit the mud or mud-water interface exhibited the highest metal concentrations of any of the organisms. Fishes that are primarily carnivorous in nature exhibited lower mean muscle concentrations of copper, nickel, lead, chromium, zinc, and cadmium than did omnivorous fishes. (Authors)

16943. Vronskiy, B. B. (Kamchatka Dept., Pacific Res. Inst. for Sea Fisheries and Oceanogr., (KOTINRO), Petropavlovsk-Kamchatskiy, USSR). 1972. REPRODUCTIVE BIOLOGY OF THE KAMCHATKA RIVER CHINOOK SALMON [Oncorhynchus tschawytscha (Walbaum)]. J. Ichthyol., 12(2): 259-273.

The reproductive biology of the chinook salmon [Oncorhynchus tschawytscha (Walb.)] on the Asiatic coast of the Pacific has been little studied. This paper contains the results of observations of chinook spawning grounds in the Kamchatka River basin, information on the dynamics of the spawning run, the time of spawning, alteration in sex composition during the run and during spawning, and the behavior of spawners on the spawning grounds. A description is given of spawning localities (current, depth, structural composition of bottom material); it is noted that the location of spawning grounds is dependent on features of the microrelief of the river bed. It is concluded on the basis of the examination of spawning redds that there are great losses of eggs in the course of spawning but these are compensated to some extent by the high survival rate of eggs and larvae in the redd.

16944. Williams, George C., Richard K. Koehn, and Jeffry B. Mitton (Mar. Sci. Res. Center, State Univ. of New York, Stony Brook, New York). 1973. GENETIC DIFFERENTIATION WITHOUT ISOLATION IN THE AMERICAN EEL, Anguilla rostrata. Evolution, 27(2): 192-204.

Elvers and more-advanced young and adults of the American eel, Anguilla rostrata were obtained from a range of 20° latitude from Vero Beach, Florida to St. John's, Newfoundland. Five loci, synthesizing the following isoenzymes, were used to estimate genetic heterogeneity among samples: alcohol dehydrogenase, sorbitol dehydrogenase, malate dehydrogenase, non-specific esterase, and phosphohexose isomerase. The existence of significant differences among localities, that must arise anew among the subgroups of each age cohort as they disperse from their place of origin, demonstrates that selection pressures are sufficient to cause gene frequency changes of the order of 10% per generation.

16945. Kozlov, V. I. 1972. EFFECT OF SALINITY ON THE INCIDENCE OF POSTHODIPLOSTOMATOSIS OF FISH. Hydrobiological Journal, 8(3): 91-92.

Increasing the salt content of a body of water is a useful means of preventing posthodiplostomatosis.

16946. Williams, E. H. 1973. INVESTIGATION OF A FISH-KILL FROM LAKE OKEECHOBEE, FLORIDA. Newsl. SE Coop. Fish. Disease Project, 10: 3.

Isolated diseases and pathology were briefly discussed. No cause of the mortalities was determined. Dacnitoides cotylophora (Nematoda), Glossitella sp., Trichodina sp., Trichophora sp. (Protozoa), Ergasilus sp. (Copepoda) were new host records for the white catfish, Ictalurus catus. (Auth.)

16947. Smith, E. J., J. L. Sykora, and M. A. Shapiro (Grad. School of Public Health, Univ. of Pittsburgh, Pittsburgh, Pennsylvania 15213). 1973. EFFECT OF LIME NEUTRALIZED IRON HYDROXIDE SUSPENSIONS ON SURVIVAL, GROWTH, AND REPRODUCTION OF THE FATHEAD MINNOW (Pimephales promelas). J. Fish. Res. Bd. Canada, 30(8): 1147-1153.

The long-term effect of lime neutralized suspended iron on fathead minnow (Pimephales promelas) survival, growth, and reproduction was assessed in a flow-through environment with a modified proportional diluter. Results of 12 months of testing reveal lower survival and declining growth of fathead minnows with an increase in lime neutralized suspended iron concentration. Hatchability and growth of fathead minnows were appreciably reduced in the lowest insoluble iron concentration tested, 1.5 mg Fe/liter. Reduced hatchability was attributed to the higher percentage of smaller particles in low lime neutralized iron concentrations. A comparison of data on survival, growth, and hatchability indicates that the safe level of suspended iron for fathead minnows presumably lies between the control and 1.5 mg Fe/liter. (Authors)

16948. Hicks, Franklin J., and William Threlfall (Dept. of Biol., Memorial Univ., St. John's, Newfoundland, Canada). 1973. METAZOAN PARASITES OF SALMONIDS AND COREGONIDS FROM COASTAL LABRADOR. J. Fish Biol., 5(3): 399-415.

Three hundred and twenty-three fish of six species (salmonids and coregonids) from four locations on the eastern coast of Labrador were examined for metazoan parasites, using conventional parasitological techniques. Twenty-four genera of parasites were recovered (3 of Monogenea, 8 of Digenea, 5 of Cestoda, 5 of Nematoda, 1 of Acanthocephala, 2 of parasitic Copepoda). Fifty-one new host records were noted. Fourteen genera of parasites were noted in Salmo salar L., while Salvelinus fontinalis (Mitchill) contained 21 genera; S. namaycush (Walbaum), 12 genera; S. alpinus (L.), 16 genera; Coregonus clupeaformis (Mitchill), 11 genera; Prosopium cylindraceum (Pallas), 11 genera. It was found that the parasite burden of the various fish species examined was not homogeneous when sample areas and sex of the fish was considered. An increase in the number of parasite species per infected host with age was seen in the case of Salmo salar, Salvelinus fontinalis, S. namaycush, S. alpinus. In Coregonus clupeaformis and Prosopium cylindraceum no such correlation was seen, this difference being related to the ecology of the fish. The parasitofauna of the various salmonid species examined was not homogeneous, significant differences being noted in the number of certain species infected with specific parasites. Significant differences were also noted in the parasite burden of the Salmonidae when compared with the Coregonidae. Food items recovered from the fish autopsied were noted. (Authors)

16949. Endo, Toshio, Mari Sakuma, Hisashi Tanaka, Kenji Ogishima, Takeshi Hara, Satoshi Ohshima, and Yoshishige Sato (Biol. Res. Lab., Tanabe Seiyaku Co., Ltd., Toda-shi, Saitama, Japan). 1973. APPLICATION OF OXOLINIC ACID AS A CHEMOTHERAPEUTIC AGENT AGAINST INFECTIOUS DISEASES IN FISHES - II. EXPLANATION OF CHEMOTHERAPEUTIC EFFECTS BY WHOLE BODY AUTOBACTERIOGRAPHY. Bull. Jap. Soc. Sci. Fish., 39(2): 173-177. In Japanese with English abstract.

We have already reported that oxolinic acid (1-ethyl-1, 4-dihydro-6, 7-methylenedioxy-4-oxo-3-quinolinecarboxylic acid) had a superior antibacterial activity against several bacterial species isolated from various fishes and exhibited chemotherapeutic effects in experimentally infected fishes. In the present study, we administered oxolinic acid to carps infected with A. liquefaciens and to rainbow trouts infected with A. salmonicida, and examined the chemotherapeutic effects of oxolinic acid by whole body autobacteriography. The autobacteriograms of carps infected with A. liquefaciens showed that at various times after administration of oxolinic acid the bacteria were totally absent in the carp tissues. A. salmonicida was also shown to be eradicated from the rainbow trout tissues 24 hours after administration of oxolinic acid. From these results we confirmed that oral administration of oxolinic acid inhibited the growth of infecting bacteria and prevented the expansion of lesions in experimentally infected carps and rainbow trouts.

16950. Pavlov, D. S., Yu. N. Sbikin, A. Ye. Vashchinnikov, and A. D. Mochek (Lab. of the Behavior of Lower Vertebrates, A. N. Severtsov Inst. of Evolutionary Morphol. and Animal Ecol., USSR Acad. of Sciences, Moscow, USSR). 1972. THE EFFECT OF LIGHT INTENSITY AND WATER TEMPERATURE ON THE CURRENT VELOCITIES CRITICAL TO FISH. J. Ichthyol., 12(4): 703-711.

The current velocities critical for fish are shown to be appreciably related to the conditions of their visual orientation. An alteration of light intensity has a particularly strong influence on the current velocities critical to fish; vision is the dominant receptor in this case. For benthic fish in which tactile reception is dominant, critical current velocities remain practically unaltered at all light intensities. Alteration of water temperature also has a very strong influence on the swimming abilities of fish. The critical current velocities for different species reach their maximum at different temperatures, which is related to the temperature characteristics of the habitats of the species investigated.

16951. Pappas, C. J., O. W. Tiemeier, and C. W. Deyoe (Dept. of Grain Sci. and Industry and Div. of Biol., Kansas State Univ., Manhattan, Kansas 66506). 1973. CHROMIC SESQUIOXIDE AS AN INDICATOR IN DIGESTION STUDIES ON CHANNEL CATFISH. Prog. Fish-Cult., 35(2): 97-98.

Chromic sesquioxide was used in feed to indicate digestion and absorption of protein, fat, and nitrogen-free extract (NFE) by channel catfish, Ictalurus punctatus. Results indicated that absorption of protein, fat, and NFE starts in the stomach within 2 hours; by 4 hours nearly 50 percent of the available nutrients had been absorbed. By 6 hours most of the feed had passed into the intestine where further digestion and absorption took place. Absorption values in the intestine reached 80% after 8 hours. The results from this preliminary study indicate that Cr_2O_3 may be used as an indicator in digestion studies with channel catfish. The feed containing 0.37% Cr_2O_3 and the indicator did not appear to affect digestion.

16952. Sonstegard, R. A., and K. S. Sonstegard (Depts. Microbiol. and Biomedical Sciences, Univ. Guelph, Guelph, Ontario, Canada). 1973. ESTABLISHMENT OF A CELL LINE FROM LYMPHOSARCOMA OF THE MUSKELLUNGE (Esox masquinongy). In vitro, 8(5): 410; Fish Health News, 2(3): p. 15.

A cell line was established from a biopsy of a nodular flank lesion of lymphosarcoma in a 5-year-old female muskellunge. The initial growth media consisted of TC H-597 supplemented with 50% fetal calf serum. After 8 months, the serum concentration was lowered to 20%. High cell densities (e.g., 6 X 10^6) were necessary to adapt the cells to maintenance in vitro. The cell density was maintained by the addition of fresh medium. The cells have been propagated as continuous static suspension cultures for 21 months. They grow as single cells or in macroscopically visible clumps. They often exhibit bizarre multinucleated forms. The cytoplasm contained numerous lamellar structures which were extruded from the cells by budding. Although no evidence of virus was detected in EM studies, reverse transcriptase assays, or cocultivation trials, other preliminary evidence suggests the lymphosarcoma syndrome to be of a viral etiology. (Authors)

16953. Watarai, Lloyd T., (Hawaii Inst. of Marine Biol., Box 1346, Kaneohe, Hawaii 96744). 1973. GROWTH RATE OF A CARANGID FISH, THE OMAKA Caranx mate, IN HAWAII. Trans. Amer. Fish. Soc., 102(3): 617-620.

A study of growth rate was initiated to ascertain the time to marketable size and the feasibility for aquaculture of the Hawaiian carangid, Caranx mate. The growth rate of Caranx mate was calculated for larvae, juveniles, and adults. Measurements of standard length and wet weight of juveniles were made every 14 days for a year; of adults, every 30 days for 3 months. The approximate growth rate for larval C. mate was 18 mm per month; of juveniles, 7.5 mm per month; and of adults, 2.3 mm per month. Marketable size is reached in approximately 7 months. (Auth.)

16954. Buchanan, Chester C. (Atlantic Estuarine Fish. Center, NMFS, NOAA, Pivers Island, P.O. Box 570, Beaufort, North Carolina 28516). 1973. OCCURRENCE OF MATURE REDFISH, Sebastes marinus, IN SPORT FISHERY OF THE NEW YORK BIGHT. NOAA Fish. Bull., 71(2): 597-598.

16955. Hokanson, Kenneth E. F., J. Howard McCormick, Bernard R. Jones, and James H. Tucker (U.S. Environ. Protection Agency, Nat'l Water Qual. Lab., Duluth, Minnesota 55804). 1973. THERMAL REQUIREMENTS FOR MATURATION, SPAWNING, AND EMBRYO SURVIVAL OF THE BROOK TROUT, Salvelinus fontinalis. J. Fish. Res. Bd. Canada, 30(7): 975-984.

Thermal requirements for brook trout reproduction were determined at a natural day-length cycle and five constant temperatures (10-21 C) and one treatment that followed the seasonal temperature regime of Lake Superior. The optimum range for growth (unrestricted rations) and relative condition factor was 10-19 C. Survival was 90% or greater and gonad growth and secondary sexual characteristics were well developed at all temperatures. The maximum temperature at which males became functionally mature and contained motile spermatozoa was 19 C. Ovulation and spawning occurred at 16 C and lower. Water temperature had little influence on time of spawning, but had a major influence on spawning activity and egg viability. The upper median effective temperature (ET50) for the number of viable eggs spawned per female was 11.7 C. The upper median tolerance limit (TL50) for normal hatch was 12.7 C; the optimum temperature was near 6 C. Major factors influencing the number of embryos surviving to hatch were spawning and incubation temperatures and age of the embryo when exposed to test temperatures. Thermal criteria that recognize seasonal changes in their thermal requirements are recommended for self-sustaining brook trout populations. (Authors)

16956. Yoshiyasu, Katsuhiko (Dept. of Otolaryngology, Fac. of Medicine, Osaka Univ., Osaka, Japan). 1973. STARCH-GEL ELECTROPHORESIS OF HEMOGLOBINS OF FRESHWATER SALMONID FISHES IN NORTHEAST JAPAN. Bull. Jap. Soc. Sci. Fish., 39(4): 449-459.

Hemoglobins of "suginoko" belonging to genus Oncorhynchus, and of "oshorokoma", "amemasu", and "miyabe-iwana" belonging to genus Salvelinus, were analyzed by starch-gel electrophoresis to examine their classification from the biochemical point of view. The results obtained seem to corroborate the theory of Nakamura et al. that taxonomically "suginoko" is a type of "yamame", and also the present author's opinion that genus Salvelinus fishes in Japan may be classified into two species on the basis of the geographical clines of pyloric caeca and gill rakers. Based on the present and other data, the phylogeny and specialization of these species were discussed with reference to the evolution of their Hb's.

16957. Svobodova, Z. (Vyzk. Ustav Ryb. Hydrobiol., Vodnany, Czechoslovakia). 1971. TOXICITY OF PESTICIDES CONTAINING PHENOXYACETIC ACID TO FISH. Bul. Vyzkumny Ustav Rybarsky, Vodnany, 7(4): 24-33; Weed Abstracts, 21(5): Abstract No. 2607, p. 417.

Herbicides were ranked 2,4,5-T + MCPA > MCPA > 2,4-D in order of toxicity to carp fry and perch; toxic, LD_{50} and lethal doses are tabulated. Clinical, pathological and anatomical data for the effects on fish are given individually for seven commercial herbicides.

16958. Wendt, Curt, and Curt Ericson (Swedish Salmon Res. Inst., Älvkarleö, Sweden and Inst. of Zool., Univ. of Gothenburg, Sweden). 1972. BLOOD GLUCOSE IN HATCHERY-REARED ATLANTIC SALMON (Salmo salar L.) FOLLOWING EXERCISE. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 204-215.

Unexercised hatchery-reared Atlantic salmon sampled during their second summer, autumn and winter showed seasonal changes in blood glucose. The lowest levels appeared in October-November, the highest in February-March. Exercise for 15 minutes at seasonally-differing water temperatures always caused a rise in blood glucose. After a further increase during the first two hours of the recovery period, a decline was observed in August, September and October. In February and March the blood-glucose level increased all the time during 15 hours of recovery. The suggestion is made that a wrong timing of the smoltification may be the cause of the changed blood-glucose picture after exercise in February and March as compared with that in August, September and October. (Authors' summ.)

16959. Negonovskaya, I. T. (State Res. Inst. for Lake and River Fish. (GosNIORKh), Leningrad, USSR). 1972. DATA ON THE FOOD OF YOUNGER AGE GROUPS OF THE PIKE-PERCH Lucioperca lucioperca (L.) IN LAKE PSKOV-CHUDSKOYE. J. Ichthyol., 12(3): 473-482.

As a result of a study of the composition of the food and the feeding rate of pike-perch in the first two years of life in different parts of Lake Pskov-Chudskoye and in different seasons, it has been established that there are differences in these indicators conditioned by the abundance and availability of food organisms. The food supply of juvenile pike-perch is discussed in relation to the growth rate of the potential forage fish.

16960. Wales, J. H., and R. O. Sinnhuber (Dept. Food Sci. and Tech., Oregon State Univ., Corvallis, Oregon). 1973. TROUT HEPATOMA: FIBROSIS AND LYMPHOCYTOSIS AS SUPPRESSIVE MECHANISMS IN THE RAINBOW TROUT (Salmo gairdneri). Anat. Record, 175, pp. 97-106; Fish Health News, 2(3): p. 17.

Fibrosis and lymphocytosis are common in aflatoxin-induced hepatoma in rainbow trout. It is suggested that these reactions may control the growth of tumors and in some cases destroy them. Nearly all of the hepatomas we have observed are fibrotic to some extent. The extent of the fibrosis seems to be age dependent and in advanced cases fibrosis appears to have disorganized the tumors to a degree which we believe is suppressive. The lymphocytosis shows a negative correlation with the size and age of the hepatoma, being found almost exclusively in the very "early" (small) hepatomas and preneoplastic nodules. It is suggested that the invasion of the tumors by lymphocytes is a host defense mechanism. (Authors' summ.)

16961. Shehadeh, Ziad H., William D. Madden, and Thomas P. Dohl (Oceanic Inst., Waimanalo, Hawaii 96795). 1973. THE EFFECT OF EXOGENOUS HORMONE TREATMENT ON SPERMIATION AND VITELLOGENESIS IN THE GREY MULLET, Mugil cephalus L. J. Fish Biol., 5(4): 479-487.

The effects of mammalian gonadotropins, methyltestosterone and partially purified salmon gonadotropin on spermiation and oocyte maturation were studied in adult grey mullet. Methyltestosterone was a potent spermiating agent in both prespawning and spawning trials. The most effective dose was 5 mg/100 g body weight. Human chorionic gonadotropin (HCG) was moderately effective at a dose rate of 20 IU/100 g body weight. Both hormones blocked resorption of milt in captive animals. The HCG, FSH/LH combination, Synahorin + mullet pituitary homogenate, and partially purified salmon gonadotropin were equally effective, at the doses used, in inducing oocyte maturation and preventing onset of atrophy before completion of vitellogenesis. Atrophy occurred in all experimental fish at mean oocyte diameter of 750 μ. The significance of this finding is discussed.

16962. Dechtiar, Alex O. (Fish and Wildl. Res. Branch, Ontario Ministry of Natural Resources, Maple, Ontario, Canada). 1973. NEW AND PREVIOUSLY DESCRIBED SPECIES OF THE GENUS Lyrodiscus (MONOGENOIDEA: ANCYROCEPHALINAE) FROM FISHES OF THE GREAT LAKES. J. Fish. Res. Bd. Canada, 30(8): 1155-1160.

The following species of the genus Lyrodiscus are recorded from Great Lakes fishes, and comparatively or originally described: Lyrodiscus rupestris n. sp., from Ambloplites rupestris of lakes Ontario, Erie, and Huron: L. longibasus from Pomoxis nigromaculatus and P. annularis from lakes Erie and Ontario. Lyrodiscus seminolensis from Lepomis macrochirus of lakes Erie and Ontario, and L. minimus from Ambloplites rupestris of Lake Ontario. The genus Lyrodiscus is emended. (Auth.)

16963. Florez, Fabio (Dept. of Animal Ecology, Univ. of Lund, Sweden). 1972. INFLUENCE OF OXYGEN CONCENTRATION ON GROWTH AND SURVIVAL OF LARVAE AND JUVENILES OF THE IDE, Idus idus (L.). Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 65-73.

16964. Thomas, Allan E. (Bur. of Sport Fish. & Wildl., Salmon-Cultural Lab., Longview, Washington 98632). 1973. SPAWNING MIGRATION AND INTRA-GRAVEL MOVEMENT OF THE TORRENT SCULPIN, Cottus rhotheus. Trans. Amer. Fish. Soc., 102(3): 620-622.

Torrent sculpins (Cottus rhotheus) migrated into the Abernathy Incubation Channel from late January to late April with most fish entering from mid-March through mid-April. Egg laying by captive females was restricted to April. A downstream migration of sculpins occurred in Abernathy Creek in May and June. The sculpins appeared to have entered the incubation channel by intragravel movement. (Auth.)

16965. Korovina, V. M., and S. M. Konovalov (Ichthyol. Lab., Zool. Inst., USSR Acad. of Sciences, Leningrad, USSR). 1972. ANATOMICAL AND HISTOLOGICAL CHARACTERISTICS OF THE MIDGUT IN FAR EASTERN SALMON OF THE GENUS Oncorhynchus. J. Ichthyol., 12(4): 721-729.

The present communication is a continuation of previous investigations on the comparative histological structure of the anterior division of the salmonid midgut.

16966. Saylor, Michael L. (Colo. State Univ., Fort Collins, Colorado 80521). 1973. EFFECT OF HARVESTING METHODS ON PRODUCTION OF FINGERLING FATHEAD MINNOWS. Prog. Fish-Cult., 35(2): 110-114.

Three harvesting procedures were used to remove fathead minnows, Pimephales promelas Rafinesque, from experimental ponds. The methods were: (1) complete periodic removal by draining, (2) incomplete periodic removal by seining, and (3) one complete removal at the end of the season. Periodic complete removal by draining increased total production in numbers of juveniles (fingerlings) by 41%. After the first harvest, draining harvested smaller fingerlings than seining did. Regardless of the method used to harvest fingerlings, 1% handling mortality was observed. The stocked optimum sex ratio and density of brood fish could not be maintained due to natural adult mortality. Water temperature and seston were interrupted by the drained harvest, but both recovered quickly after refilling and did not appear to retard production of fingerlings. (Auth.)

16967. Watanabe, Etuo, and Kazuo Ando (Tokyo Univ. of Fisheries, Minato-ku, Tokyo, Japan). 1972. CHANGES IN CHOLESTEROL IN DEVELOPING RAINBOW TROUT EGG. Bull Jap. Soc. Sci. Fish., 38(7): 711-715. In Japanese with English abstract.

Cholesterol in the free and esterified forms and the esterforming fatty acids were studied in the rainbow trout egg during its development. In the fertilized egg, free cholesterol decreased slightly while the esterified form increased, there being a slight decrease in the sum of these two. Until eyeing stage some of the ester-forming fatty acids increased while others decreased, the former being $C_{16:1}$, $C_{18:0}$, $C_{18:1}$ and $C_{18:4}+C_{20:1}$, the latter being $C_{12:0}$, $C_{14:0}$, $C_{16:0}$ and $C_{18:2}$. Almost all the fatty acids were maximal after the hatching stage. Unfertilized egg which was kept alive for 24 days under the same conditions as the fertilized showed a remarkable increase in lower fatty acids (less than 12 carbon atoms) during this period. These observations may suggest that cholesterol plays an important role in fat metabolism in the developing egg.

16968. Newcombe, C., and G. Hartman (Dept. of Zool., College of Biol. Sci., Univ. of Guelph, Guelph, Ontario, Canada). 1973. SOME CHEMICAL SIGNALS IN THE SPAWNING BEHAVIOR OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(7): 995-997.

In a two-choice maze ripe rainbow trout (Salmo gairdneri) of both sexes showed positive responses to chemical (probably olfactory) information. The possibility that visual or auditory stimuli influenced choice of channel in the maze was ruled out. Both males and females were strongly attracted to water taken from behind fish that were spawning and weakly attracted to the holding water of ripe fish that were not spawning. Brief speculation is offered about the role of chemical stimuli in the behavior of prespawning and spawning trout. (Authors)

16969. Makeyeva, A. P. (Dept. of Ichthyol., Moscow State Univ., Moscow, USSR). 1972. HYBRIDIZATION OF THE BIGHEAD [Aristichthys nobilis (Rich.)] AND THE CARP (Cyprinus carpio L.). J. Ichthyol., 12(2): 274-282.

A study has been made of the embryonic and larval development of bighead (females) - carp (males) hybrids. Fertilization of the hybrid eggs reached 75-98%. Development of the eggs was synchronous with development of the maternal eggs until commencement of segmentation of the trunk mesoderm. Thereafter the hybrid eggs began to lag behind in development. Most embryos deviated in development toward the male parent, and only 0.036 toward the female. Anomalies which led to the death of the larvae developed in almost all of them. Only 0.01% of the larvae survived; these had no anomalies, were externally indistinguishable from the mother and probably were examples of gynogenesis. Karyological analysis showed that the hybrids had an approximately intermediate number of chromosomes by comparison with the parents. The size of nuclei in the fin fold of the hybrids was found to be significantly less than in the parents.

16970. Shimeno, Sadao, and Masahiko Takeda (Dept. of Cultural Fisheries, Fac. of Agric., Kochi Univ., Nangoku, Kochi Pref., Japan). 1973. STUDIES ON HEXOSE MONOPHOSPHATE SHUNT OF FISHES - II. DISTRIBUTION OF GLUCOSE-6-PHOSPHATE DEHYDROGENASE. Bull. Jap. Soc. of Sci. Fish., 39(4): 461-466. In English.

Glucose-6-phosphate dehydrogenase activities in various fish organs, in the livers of various fish species, and in the subcellular components of fish liver were assayed in order to elucidate the distribution of the enzyme in fishes. High levels of glucose-6-phosphate dehydrogenase activity were found in liver, and low values in kidney and digestive tract, while the activity was scarcely detectable in heart tissue, ordinary and dark meats. All the fish livers tested contained the enzyme activity, though the levels of the activity were variable according to the species of fish. In the subcellular components of yellowtail liver, high specific activity was found in the supernatant fraction, in which 93.4% of the total activity was present.

16971. Nursall, J. R. (Dept. of Zool., Univ. of Alberta, Edmonton T6G 2E1, Alberta, Canada). 1973. SOME BEHAVIORAL INTERACTIONS OF SPOTTAIL SHINERS (Notropis hudsonius), YELLOW PERCH (Perca flavescens), AND NORTHERN PIKE (Esox lucius). J. Fish. Res. Bd. Canada, 30(8): 1161-1178.

Dense schools of spottail shiners (Notropis hudsonius) are common in shallow water in Beaver Lake, generally 0.25-0.30 m below the surface, with smaller individuals more numerous towards the top. Position in the school is maintained by short radius behavior. The course of an individual is maintained by a beat of the tail, a glide, a hesitation, and a change of direction. Each glide path represents the chord of an arc of short radius about some neighbor. Shiners respond to disturbance by flash expansion of loose cruising association. Schooling is obligatory. The black caudal spot is probably multifunctional as a recognition mark and releaser. Yellow perch (Perca flavescens) show an ontogeny of behavior through young-of-the-year, aggregation-sized perch (aggp), subadults, and adults. They behave as individuals or associate as streams. Disturbance will cause a group of aggp to disperse or to stream. The adult manifestation of streaming is pack-hunting. The activity of one perch attracts the attention of others; this leads to streaming or pack-hunting. Pack-hunting improves the chance of some members of the pack, not necessarily the initiator, capturing active prey, by countering the allaesthetic protean escape reactions of organisms such as the spottail shiner. Large mixed aggregations of spottail shiners and aggp are fortuitous. Northern pike (Esox lucius) are lone, opportunistic predators whose hunting technique combines in sequence motionlessness, axial tracking, and lunging. Prey may be swallowed head- or tailfirst, or sideways. The species studied here show a range of gregariousness, from the solitary pike, through the facultative nonpolarized and polarized schools of perch, to obligate nonpolarized and polarized schools of shiners. (Auth.)

16972. Becker, C. Dale. 1973. COLUMBIA RIVER THERMAL EFFECTS STUDY: REACTOR EFFLUENT PROBLEMS. J. Wat. Poll. Contr. Fed., Wash., 45(5): 850-869.

16973. Sutterlin, A. M., and R. Gray (Fish Res. Bd. Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1973. CHEMICAL BASIS FOR HOMING OF ATLANTIC SALMON (Salmo salar) TO A HATCHERY. J. Fish. Res. Bd. Canada, 30(7): 985-989.

Based on recoveries from traps situated at a hydroelectric dam and a hatchery 1500 m downstream, the return location of hatchery reared and wild Atlantic salmon is examined. During the fall runs of 1971 and 1972, 97% of ascending wild salmon returned to the dam; only 3% were recovered at the hatchery. Despite the fact that the hatchery discharge contributed only 1/1000th of the river's flow, 67% of the hatchery-reared fish returned to the hatchery and 33% to the dam. Tank tests demonstrated a clear-cut preference by hatchery adults for diluted hatchery effluent vs. river water. Wild fish showed no preference to either water. Well water, a component of hatchery effluent, was avoided by both hatchery and wild fish. Addition of $CuSO_4$ to preferred water altered its effectiveness. (Authors)

16974. Pardue, Garland B. (Auburn Univ. Agric. Exp. Sta., Auburn, Alabama 36830). 1973. PRODUCTION RESPONSE OF THE BLUEGILL SUNFISH, Lepomis macrochirus Rafinesque, TO ADDED ATTACHMENT SURFACE FOR FISH-FOOD ORGANISMS. Trans. Amer. Fish. Soc., 102(3): 622-626.

Bluegill sunfish, Lepomis macrochirus (Rafinesque) were stocked at a rate of 20,000/ha into 40 plastic pools, each 3 m in diameter, containing water to a depth of 76 cm. Added attachment surfaces (yellow pine boards) for fish-food organisms were placed in 36 plastic pools in amounts corresponding to 20, 40, 60, 80, and 100% of the water surface area. Fertilizers with 8-8-2 (N-P-K), 0-8-0 (N-P-K), and a control with no fertilizer were used throughout the study. The addition of pine boards resulted in linear increases in both fish food and fish production. Significant increases occurred when additions of attachment surface equal to the surface area of the pool were added. Complete (8-8-2, N-P-K) fertilization produced the greatest weight of macroinvertebrates and bluegills. (Auth.)

16975. Radakov, D. V., and M. A. Sivertsev (A. N. Severtsov Inst. of Evolutionary Morphol. and Animal Ecol. (IEMEZh), USSR Acad. of Sciences, Moscow, USSR). 1972. PROCEDURE FOR STRUCTURAL DESCRIPTION OF SCHOOLING MOVEMENTS IN FISH. J. Ichthyol., 12(4): 730-733.

Although some attempts have been made at the mathematical description of a fish school, no procedure has previously been devised for structural description of the behavior of fish in schools and of the school as a whole. The present article is an attempt at such a description. The behavior of Leucaspius delineatus in a school, when reacting to the movement of a stimulator in the form of a model of a predator, is considered as an example.

16976. Shelbourn, J. E., J. R. Brett, and S. Shirahata (Fish. Res. Bd. Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. EFFECT OF TEMPERATURE AND FEEDING REGIME ON THE SPECIFIC GROWTH RATE OF SOCKEYE SALMON FRY (Oncorhynchus nerka), WITH A CONSIDERATION OF SIZE EFFECT. J. Fish. Res. Bd. Canada, 30(8): 1191-1194.

Specific growth rates were obtained for sockeye fry (Oncorhynchus nerka) acclimated to four temperatures and fed excess ration over a 36-day period, starting at an initial weight of 0.4 g. The rates were 2.2 (5 C), 5.1 (10 C), 6.5 (15 C), and 6.1 (20 C) % wet weight/day. Continuous feeding for 15 hr/day at 20 C produced a significantly greater growth rate than feeding to satiation three times daily ($P < 0.05$). The growth rates are compared to those obtained for larger sockeye, determined in earlier experiments. (Authors)

16977. Yoshida, Tamao, and Minoru Nomura (Tokyo Univ. of Fisheries, Minato-ku, Tokyo, Japan). 1972. A SUBSTANCE ENHANCING SPERM MOTILITY IN THE OVARIAN FLUID OF RAINBOW TROUT. Bull. Jap. Soc. Sci. Fish., 38(9): 1073.

A substance both enhancing sperm motility and prolonging survival time of sperm in the ovarian fluid of rainbow trout was found to be fractionated with gel filtration. It was postulated to be of a comparatively small molecular weight between 1,000 to 3,000. Its isolation and characterization are now under progress.

16978. Kokhmenko, L. V. (Kamchatka Dept., Pacific Res. Inst. for Sea Fish. and Oceanogr. (KOTINRO), Petropavlovsk-Kamchatskiy, USSR). 1972. THE FOOD OF THE MYKISS [Salmo mykiss (Walb.)] IN KAMCHATKA. J. Ichthyol., 12(2): 282-291.

Information is given concerning the food of the mykiss in various waters in the Kamchatka River basin. An analysis is made of the food of underyearlings and yearlings from the Kishimshina River (a spawning river). Consideration is given to a composition of the food of adult fish from a foothill tributary of the middle reaches of the Kamchatka River - the Nikolka River, in Lake Azabach'ye and in the Azabach'ya River, which joins the lake to the Kamchatka River (lower reaches). The impact of mykiss on the reproduction of salmon stocks is small owing to its relatively low abundance. As a predator it causes some damage, destroying young salmon, but by consuming food competitors it improves their feeding conditions. The varied diet of the mykiss suggests its potential for fish culture and acclimatization.

16979. Marcy, Barton C., Jr. (Essex Marine Lab., Essex, Connecticut 06426). 1973. VULNERABILITY AND SURVIVAL OF YOUNG CONNECTICUT RIVER FISH ENTRAINED AT A NUCLEAR POWER PLANT. J. Fish. Res. Bd. Canada, 30(8): 1195-1203.

Most of the young fish of nine species that were entrained in the condenser cooling-water system of the Connecticut Yankee nuclear power plant were dead by the time they reached the lower end of the plant's 1.83-km (1.14 mile) long discharge canal. Sampling during June and July, when 95% of the nonscreenable fish were abundant near the plant's intake, showed that approximately 80% of the mortality in the canal was caused by mechanical damage and 20% was attributed to heat shock and prolonged exposure to temperatures elevated above 28 C. There was no measurable mortality due to the injection of sodium hypochlorite into the system as a biocide. The number of nonscreenable living fish entrained at the intake averaged about 4% (range, 1.7-5.8%) of those passing by the plant under conditions of unidirectional net tidal flow. (Auth.)

16980. Shehadeh, Ziad H., Ching-Ming Kuo, and Kathy K. Milisen (Oceanic Inst., Waimanalo, Hawaii 96795). 1973. VALIDATION OF AN in vivo METHOD FOR MONITORING OVARIAN DEVELOPMENT IN THE GREY MULLET (Mugil cephalus L.). J. Fish Biol., 5(4): 489-496.

The validity of using extruded intra-ovarian oocytes for in vivo assessment of ovarian maturity in the grey mullet was established. The diameter of sampled, unfixed oocytes was used as a reference point for comparative purposes. Analysis of variations in oocyte diameters among samples removed from seven different ovarian locations indicated that mullet oocytes develop in synchrony and that in vivo samples taken from any area in the ovary would be representative of the entire ovary. Statistical analyses of oocyte diameters and diameter-frequency distributions data from duplicate in vivo samples removed from the same ovarian site in each of 17 females showed no significant differences and validated the accuracy of the method. Similar comparisons of data from in vivo and in vitro samples revealed no statistically significant differences. (Authors)

16981. Erman, Don C. (School of Forestry and Conservation, Univ. of Calif., Berkeley, California 94720). 1973. UPSTREAM CHANGES IN FISH POPULATIONS FOLLOWING IMPOUNDMENT OF SAGEHEN CREEK, CALIFORNIA. Trans. Amer. Fish. Soc., 102(3): 626-629.

Fish populations were compared before (1952-1961) and after (1970-1972) construction of Stampede Reservoir in a mile of Sagehen Creek above the reservoir. Relative abundance and species composition were quite different after reservoir construction. Suckers (Catostomus platyrhynchus and C. tahoensis) are now numerically dominant (79% of all fish); whereas, formerly they made up 18% (by numbers) of the fish composition. Rainbow trout have increased, but brown trout and whitefish have decreased; and brook trout have not been collected since impoundment. Reservoir construction is the only major change in the Sagehen Creek watershed. (Auth.)

16982. Jensen, A. L. (Environ. Protection Agency, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, Florida 32561). 1973. RELATION BETWEEN SIMPLE DYNAMIC POOL AND SURPLUS PRODUCTION MODELS FOR YIELD FROM A FISHERY. J. Fish. Res. Bd. Canada, 30(7): 998-1002.

Dynamic pool models without self-regenerating properties are continuous age models, and surplus production models are continuous time models. Self-regenerating dynamic pool models are continuous age-discrete generation models and, also, discrete time-discrete age models. In a steady state specification of the regulatory function and direct estimation of biomass results in the surplus production model. Estimation of biomass by specifying the functions with respect to age for size of a cohort and individual weight and application of the coefficient of fishing mortality result in the dynamic pool model. A third approach, not applied in fisheries, is to specify the regulatory function and functions with respect to age of cohort size and individual growth in weight. In a steady state all methods for calculating yield give the same results if the functions specified are realistic. Specification of the functions requires that many assumptions be made. The dynamic pool model may be more accurate than the surplus production model because the regulatory function may be more difficult to determine than the functions with respect to age of cohort size and growth in individual weight. (Auth.)

16983. Brusven, M. A. (Dept. of Entomol., Univ. of Idaho, Moscow, Idaho 83843). 1973. A CLOSED SYSTEM PLEXIGLAS STREAM FOR STUDYING INSECT-FISH-SUBSTRATE RELATIONSHIPS. Prog. Fish-Cult., 35(2): 87-89.

A closed-system Plexiglas stream of linear design with semicircular ends is described. The stream has been found to be an effective laboratory apparatus for studying insect-fish-substrate relationships and for critically evaluating substrate as a limiting factor in the autecology of insects and fish. The linear-semicircular design eliminates blockages inherent to linear channel streams, thereby permitting free movement of organisms within. Plexiglas construction allows maximum observational qualities for studying microecological relationships. In addition to organism-substrate investigations, studies involving respiration, bioenergetics, and population and community dynamics are also envisaged, with only minor modifications of the basic stream design to fit the needs of the investigator. (Auth.)

16984. Roberts, Ronald J., A. MacQueen, W. M. Shearer, and H. Young (Aquatic Pathobiol. Unit, Univ. of Stirling, Scotland). 1973. THE HISTOPATHOLOGY OF SALMON TAGGING I. THE TAGGING LESION IN NEWLY TAGGED PARR. J. Fish Biol., 5(4): 497-503.

Histopathological studies were carried out on the pathogenesis of the lesion induced by the insertion of a light plastic identification tag, in salmon parr on the river North Esk, Scotland. The experiments were carried out at mean water temperature of 12°C, 8°C and 4°C. The inflammatory response was similar at each temperature, but the rate of its development was markedly inhibited at 4°C. The qualitative response at the lower temperature was also slightly different in that polymorphonuclear leukocytes appeared to play a slightly more dominant role and the connective tissue response, which in all cases outweighed myofibrillar regeneration was more cellular at that temperature. The tagging lesion provides a very suitable model for the study of short and long term inflammation in salmonids and studies on the modification of these defensive mechanisms by temperature. (Authors)

16985. Tomlinson, N., and E. G. Baker (Fish. Res. Bd. Canada, Vancouver Lab., Vancouver, British Columbia, Canada). 1973. SEXUAL RIPENING OF PACIFIC HALIBUT (Hippoglossus stenolepis) IN CAPTIVITY. J. Fish. Res. Bd. Canada, 30(8): 1255-1256.

Five female Pacific halibut, ranging between 89 and 105 cm long and between 10.4 and 17.9 kg, and three males, between 79 and 99 cm and 6.34 and 13.3 kg, became sexually ripe after being held in captivity for 21 months. This apparently is the first record of this development in the species in captivity. (Authors)

16986. Graves, William E., and Judith H. Kogel (Dept. of Forest Zool., State Univ. Coll. of Environ. Sci. and Forestry, Syracuse, New York 13210). 1973. EFFECTS OF WATER VOLUME AND CHANGE OF WATER ON GROWTH AND SURVIVAL OF YELLOW PERCH. Prog. Fish-Cult., 35(2): 115-117.

Yellow perch fingerlings were subjected to one of three different water conditions: (1) no water change, (2) water change every 3 days with prior yearling occupancy, and (3) water change every 3 days with no prior occupancy. In addition, these treatments were made in three different volumes: 40, 20, or 10 liters with 20 fish per subgroup. Mortality was 100% in group 1, but the time of occurrence was in direct proportion to tank size, i.e., 9 days in 10 liters, 14 days in 20 liters and 20 days in 40 liters. Group 2 mortality was high but 100% only in 10 liters. Group 3 mortality averaged only 5% overall and occurred only in 10 liters. These data suggest some concentration-dependent lethal condition capable of being produced by the yearlings themselves. Growth rates in these fish also appeared dependent on volume and in particular in group 3 where fish in 40 liters grew at nearly twice the rate of those in 20 or 10 liters. These data suggest that auto-inhibition of growth can take place in perch fingerlings and that there may be growth inhibitors separate from toxic substances capable of inducing mortality. (Authors)

16987. Kaczynski, V. W., R. J. Feller, and J. Clayton (Dept. of Oceanog., Univ. of Wash., Seattle, Washington 98195). 1973. TROPHIC ANALYSIS OF JUVENILE PINK AND CHUM SALMON (Oncorhynchus gorbuscha AND O. keta) IN PUGET SOUND. J. Fish. Res. Bd. Canada, 30(7): 1003-1008.

Pink and chum salmon (Oncorhynchus gorbuscha and O. keta) fry and Clarke-Bumpus plankton tows were collected from three beach areas in Puget Sound in spring 1970. Chum fry and benthic pump samples were taken in 1971. The diets of the young of the two species were similar. Epibenthic harpacticoid copepods were the chief prey of the chum and pink salmon (57 and 36%, respectively, in 1970). Distinct differences were apparent, the more notable being the preference for invertebrate eggs exhibited by the pinks and the higher preferences for small gammarid amphipods and harpacticoids exhibited by the chums. The stomach contents showed no resemblance to the plankton hauls taken in the same area. The onshore stage of development appears to be a distinct ecological stage in the life cycles of these species. (Authors)

16988. Martin, F. Douglas, and Rollin C. Richmond (Radioecol. Section, Puerto Rico Nuclear Center, Coll. Sta., Mayaguez, Puerto Rico 00708). 1973. AN ANALYSIS OF FIVE ENZYME-GENE LOCI IN FOUR ETHEOSTOMID SPECIES (PERCIDAE: PICES) IN AN AREA OF POSSIBLE INTROGRESSION. J. Fish Biol., 5(4): 511-517.

The possibility of natural hybridization between two species of darters, Etheostoma spectabile and caeruleum was investigated using the technique of starch gel electrophoresis of skeletal muscle homogenates. Inter- and intraspecific genetic variability at five enzyme loci was found. Presumed morphological hybrids are most probably not genetic hybrids as judged by their enzyme genotypes. The analysis of enzyme variability supports a previously published phylogeny for the darters. (Authors)

16989. Danilenko, T. P. (Inst. of Hydrobiol., Ukrainian Acad. of Sci., Kiev, USSR). 1972. GLYCOGEN DYNAMICS IN PHASE E OOCYTES IN THE POND CARP [Cyprinus carpio (L.)]. J. Ichthyol., 12(2): 291-296.

A study has been made of glycogen content in phase E oocytes of carp throughout the spawning season. It was established that the older generation of oocytes in the ovaries of females in the first half of this season was in subphase E_1. The second half of the season was typified by the presence of oocytes in subphases E_2 and E_3 in the females. Glycogen content in the eggs increases continuously throughout the spawning season, and the level of its accumulation is not the same from one subphase to another. A noteworthy feature is the lack of ovulated eggs following pituitary injections administered to females in whom the older generation of oocytes was initially in subphase E_3.

16990. O'Connor, J. F., and G. Power (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1973. HOMING OF BROOK TROUT (Salvelinus fontinalis) IN MATAMEK LAKE, QUEBEC. J. Fish. Res. Bd. Canada, 30(7): 1012-1014.

Brook trout (Salvelinus fontinalis) showed both in-season and repeat homing to spawning tributaries of Matamek Lake, Quebec. Of 283 trout clipped from Gallienne Creek and Kaikhosru Creek during August and September, 1971, 31.1% returned to the homestreams to spawn in 1972. During July and August, 1972, 450 trout were tagged and displaced from these two streams and released at three points (0.20-4.50 km) in the lake. Of these fish, 44.0% homed, 0.2% strayed to the opposite stream and the remainder were unaccounted for. Percentage returns from the deepwater release point was much lower than returns from the two inshore release points, and average return time was proportional to the distance from the homestream. (Authors)

16991. Endo, Toshio, Kenji Ogishima, Hisashi Tanaka, and Satoshi Ohshima (Biol. Res. Lab., Tanabe Seiyaku Co., Ltd., Toda-shi Sutama, Japan). 1972. STUDIES ON THE ANESTHETIC EFFECT OF EUGENOL IN SOME FRESH WATER FISHES. Bull. Jap. Soc. Sci. Fish., 38(7): 761-767. In Japanese with English abs.

Eugenol (4-allyl-2-methoxyphenol) was found to exhibit an anesthetic effect on various fishes. Carp, Cyprinus carpio, medaka, Oryzias latipes, crucian carp, Carassius auratus, and rainbow trout, Salmo gairdnerii irideus were anesthetized in a short time in water containing 12.5 to 100 ppm of eugenol as added to water in the form of FA-100 (a pharmaceutical preparation of 10% eugenol). Eugenol was effective at only one fourth the concentration of MS-222 that would give comparable effects in gold fish, Carassius auratus, medaka and crucian carp. Anesthesia by FA-100 and recovery from it required longer time at low water temperatures (5 and 10°C) than at normal temperature (24.5°C).

16992. Roslyy, Yu. S. (Lab. of Diadromous Salmonids, Amur Dept., Pacific Res. Inst. for Sea Fish. and Oceanog. (TINRO), Khabarovosk, USSR). 1972. THE SCALE STRUCTURE OF THE AMUR CHUM [Oncorhynchus keta (Walb.)] AS AN INDICATOR OF GROWTH AND LIVING CONDITIONS IN THE FRESHWATER STAGE. J. Ichthyol., 12(3): 483-497.

Consideration is given to the effect of river discharge on the growth of the Amur chum at the beginning of the first year of life. A study of the growth rate and scale structure demonstrated that juvenile chum grow better in the rivers and, apparently, in brackish inshore waters in years of low discharge during the downstream migration.

16993. Savitz, J. (Biol. Dept. Loyola Univ. of Chicago, 6525 North Sheridan Road, Chicago, Illinois 60626). 1973. INFLUENCE OF LOW LEVEL HANDLING STRESS ON NITROGEN EXCRETION OF BLUEGILL SUNFISH (Lepomis machrochirus Rafinesque). Trans. Amer. Fish. Soc., 102(3): 629-630.

Low level handling stress did not have any significant effect on nitrogen excretion rates of bluegill sunfish. (Auth.)

16994. Harris, J. E. (Dept. of Biol. Sciences, Univ. of Exeter, Devon, United Kingdom). 1973. THE APPARENT INABILITY OF CYPRINID FISH TO PRODUCE SKIN-SENSITIZING ANTIBODY. J. Fish Biol., 5(4): 535-540.

Both egg albumin and horse serum failed to induce systemic anaphylactic shock in cyprinid fish. The production of skin-sensitizing antibody by these fish to either horse serum, egg albumin or antigenic extracts of the cestode, Caryophyllaeus laticeps or the acanthocephalan, Pomphorhynchus laevis, could not be demonstrated by homologous passive cutaneous anaphylaxis (PCA) or by heterologous PCA reaction in guinea-pigs. It was considered therefore, that fish are unable to produce such antibody, at least in response to these antigens, and that it is unlikely that skin-sensitizing antibody is involved in the rejection of C. laticeps by dace Leuciscus leuciscus (L.). The phylogenetic origins of skin-sensitizing antibody are discussed. (Auth.)

16995. McCart, P., and P. Craig (Dept. of Biol., Univ. of Calgary, Calgary, Alberta, Canada). 1973. LIFE HISTORY OF TWO ISOLATED POPULATIONS OF ARCTIC CHAR (Salvelinus alpinus) IN SPRING-FED TRIBUTARIES OF THE CANNING RIVER, ALASKA. J. Fish. Res. Bd. Canada, 30(8): 1215-1220.

Two isolated populations of Arctic char (Salvelinus alpinus) in spring-fed tributaries of the Canning River, Alaska, had meristic characters that corresponded to those of the Western Arctic-Bering Sea form of Arctic char. The two populations demonstrated slight differences in growth rates, age at maturity, longevity, and food habits. The fish were characterized by small size (maximum 235 mm), low growth rates, low fecundities (maximum 199 eggs), and annual spawning after maturity. Mature fish were darkly pigmented and parr marks were retained throughout life. The spawning season appeared to be sometime in November, when the eggs of mature females averaged 3.8 mm in diameter. (Authors)

16996. Plisetskaya, E. M., and V. V. Kuz'mina (Lab. of the Evolution of Endocrine Functions, I. M. Sechenov Inst. of Evol. Physiol. and Biochem., USSR Acad. of Sciences, Leningrad, USSR). 1972. GLYCOGEN CONTENT IN ORGANS OF AGNATHA (CYCLOSTOMATA) AND FISH (PISCES). J. Ichthyol., 12(2): 297-306.

A critical summary is made of the authors' own data and published data on glycogen content in the liver, skeletal and heart muscles and brain of cyclostomes and fish. Information is given concerning variation in the amount of glycogen in the organs under the influence of a number of factors: water temperature, season, fasting, the stage in the sexual cycle and muscular activity.

16997. Lindstrom, Thorolf. 1972. EXPERIMENTS WITH WHITEFISH FRY IN ENCLOSURES IN NATURE. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 52, pp. 85-89.

16998. Hines, Ron S., and Dan T. Spira (Agric. Res. Organization, Fish and Aquaculture Sta., Dor, Israel). 1973. ICHTHYOPHTHIRIASIS IN THE MIRROR CARP. II. LEUKOCYTE RESPONSE. J. Fish Biol., 5(4): 527-534.

Changes in leukocyte counts in mirror carp infected with Ichthyophthirius multifiliis were recorded during the disease. Leukocytes were classified according to their appearance and stage of development. The overall white blood cell count in infected carp remained within the range found in normal carp under similar conditions. The first recognizable event in leukocyte dynamics was a sharp but temporary drop in lymphocytes with a concurrent rise in neutrophil percentages early in the infection. A similar trend also appeared towards the end of the infection. A significant shift towards younger cell populations was evident among the neutrophils. Blast cells with morphological characteristics of neutrophils appear in the circulation. The percentage of these cells and of other blast cells rose progressively during the infection. The number of cells termed fine reticular cells, also rose during infection. White blood cell changes in the mirror carp infected with I. multifiliis were similar to changes observed for other diseases and also in response to certain stress conditions. (Authors)

16999. Horning, W. B., II, and R. E. Pearson (U. S. Environ. Protection Agency, Newtown Fish Toxicol. Sta., Cincinnati, Ohio 45244). 1973. GROWTH TEMPERATURE REQUIREMENTS AND LOWER LETHAL TEMPERATURES FOR JUVENILE SMALLMOUTH BASS (Micropterus dolomieui). J. Fish. Res. Bd. Canada, 30(8): 1226-1230.

Maximum growth rate of juvenile smallmouth bass (Micropterus dolomieui) grown at constant temperatures of 16, 23, 26, 29, 32, and 35 C, occurred at approximately 26 C. Fish held at 35 C demonstrated a negative growth rate. The average 96-hr low temperature TL50 values (median tolerance limit) varied from 1.6 to 10.1 C for smallmouth bass acclimated to 15 and 26 C, respectively. Intermediate values were obtained for fish acclimated to 18 and 22 C. An important aspect of the study was the occurrence of a secondary fungous infection on the fish after 96-hr exposure to cold temperatures. In some cases the infection was severe enough to cause complete mortality within 7 days. (Authors)

17000. Shterman, L. Ya., and V. R. Slobodskoy (Zool. Inst., USSR Acad. of Sciences and Dept. of Endocrinology, Med. Post Grad. Training Inst., Leningrad, USSR). 1972. THE EFFECT OF BETAZINE AND IODINE ON GROWTH, THE FUNCTIONAL STATE OF THE THYROID GLAND AND BLOOD INDICES IN RAINBOW TROUT [Salmo irideus (Gibbons)]. J. Ichthyol., 12(3): 498-504.

We investigated the effect of growth and physiological condition of rainbow trout of different ages, after adding iodine as the preparation betazine and in Lugol's solution in their food. We established the most favorable doses of iodine and also a correlation between the observed return in fish rearing and reduction in the functional activity of the thyroid gland.

17001. Lee, D. J., and J. H. Wales (Dept. of Food Sci. and Technol., Oregon State Univ., Corvallis, Oregon 97331). 1973. OBSERVED LIVER CHANGES IN RAINBOW TROUT (Salmo gairdneri) FED VARYING LEVELS OF A CASEIN-GELATIN MIXTURE AND HERRING OIL IN EXPERIMENTAL DIETS. J. Fish. Res. Bd. Canada, 30(7): 1017-1020.

Young rainbow trout (Salmo gairdneri) were fed semipurified diets containing varying levels of herring oil, casein-gelatin (70-30), and starch for 18 weeks. Fish fed diets containing 53% protein and fat levels of 8 and 16% developed livers with abnormal nuclei, bile duct proliferation, and some parenchymal cell injury. The same level of protein with 24% herring oil did not produce these liver changes. Increasing protein levels with concurrent lowering of starch content produced large livers that were high in glycogen. This effect was not as pronounced at the high level (24%) of fat. The liver abnormalities apparently did not impair growth since weight gains were unrelated to the condition of the liver histology. (Authors)

17002. Dominy, C. L., and G. L. Myatt (Resource Develop. Branch, Fish. Serv., Dept of the Environ. of Canada, Halifax, Nova Scotia, Canada). 1973. SHORT-TERM EFFECTS OF THREE DIFFERENT MARKS ON THE RECAPTURE AND SURVIVAL OF THE ALEWIFE, Alosa pseudoharengus. Trans. Amer. Fish. Soc., 102(3): 633-637.

A paper fastener on the left operculum of alewives (Alosa pseudoharengus) proved to be superior as an easily recognized mark when compared to a paper fastener on the left pectoral fin and an alligator clip on the dorsal fin in a combined experimental approach employing a field and a controlled test. In the field test, fish marked on the operculum gave a significantly greater number of recoveries, while in the controlled test, the operculum treatment showed a significantly lower mortality rate than the two other marks. The results indicate that fins may be less desirable than the operculum as sites for the placement of tags on alewives. (Authors)

17003. House, Robert, and LaRue Wells (Great Lakes Fish. Lab., Bur. of Sport Fish. & Wildl., Ann Arbor, Michigan 48107). 1973. AGE, GROWTH, SPAWNING SEASON, AND FECUNDITY OF THE TROUT-PERCH (Percopsis omiscomaycus) IN SOUTHEASTERN LAKE MICHIGAN. J. Fish. Res. Bd. Canada, 30(8): 1221-1225.

Growth of trout-perch (Percopsis omiscomaycus) in the first 2 years of life was somewhat slower in southeastern Lake Michigan (average length at end of second year, 83 mm) than in Lower Red Lake, Minnesota (90 mm), but considerably faster than in Lake Superior (58 mm); size differences in later years were slightly less pronounced. Young fish began growing earlier in the year (some before June 20) than older ones (as late as August). Females tended to live longer than males, as they do in Lower Red Lake and Lake Superior. Trout-perch spawned from late June or early July until late September, somewhat later than in Lower Red Lake (May to August) or Lake Erie (June to August). Fecundity was similar to that in Lake Erie; mature females 94-146 mm long contained from 126 to 1329 yolked eggs. (Authors)

17004. Bruhn, David S., and J. T. Bowen (Bur. Sport Fish. & Wildl., Manchester Iowa). 1973. SELECTION OF RAINBOW TROUT BROODSTOCK, 1968. Prog. Fish-Cult., 35(2): 119-120.

17005. Tsvetkov, V. I., D. S. Pavlov, and V. K. Nezdoliy (Lab. of the Orientation and Signaling Systems of Lower Vertebrates, A. N. Severtsov Inst. of Evol. Morphol. and Animal Ecol. (IEMEZh), USSR Acad. of Sciences, Moscow, USSR). 1972. CHANGES OF HYDROSTATIC PRESSURE LETHAL TO THE YOUNG OF SOME FRESHWATER FISH. J. Ichthyol., 12(2): 307-318.

The effect of sharp changes of hydrostatic pressure on fish leads to the death not only of physoclistic, but also of physostomous fish adapted to increased pressure. The fish do not die if the rate of decompression, i.e., the rate of adaptation to the pressure drop corresponds to the rate at which pressure is reduced. Lethal amounts and rates of pressure drop have been found and the characteristics of the behavior of 11 species of freshwater fish on sharp pressure change have been described. The early young of fish possessing a swim bladder are more sensitive to pressure drop than are older individuals. The data obtained justify us in considering that the large quantity of young fish (11-67%) which perish on passing through the turbines of high pressure hydroelectric power stations of the type installed in conjunction with a dam perish as a result of the change of hydrostatic pressure in the turbines. This applies in particular to fish which enter the turbine from the benthopelagic layers of the water and which have previously been adapted to the increased pressure of the forebay.

17006. LeGore, Richard S., and David M. DesVoigne (Coll. of Fish., Univ. of Wash., Seattle, Washington 98195). 1973. ABSENCE OF ACUTE EFFECTS ON THREESPINE STICKLEBACKS (Gasterosteus aculeatus) AND COHO SALMON (Oncorhynchus kisutch) EXPOSED TO RESUSPENDED HARBOR SEDIMENT CONTAMINANTS. J. Fish. Res. Bd. Canada, 30(8): 1240-1242.

Threespine sticklebacks (Gasterosteus aculeatus) and coho salmon fry (Oncorhynchus kistuch) were challenged in static 96-hr bioassays with suspensions of sediment from the Duwamish Waterway, Seattle, Wash. Doses of up to 5% wet weight (28.8 g/liter dry weight basis) were used. No observable effect on the fish of contaminants released from the sediment was elicited, although high levels of these contaminants, such as volatile solids, COD, organic nitrogen, oil and grease, zinc, and lead, were present. (Authors)

17007. Marcy, B. C., Jr., and R. C. Galvin (Essex Marine Lab., Essex, Connecticut 06426). 1973. WINTER-SPRING SPORT FISHERY IN THE HEATED DISCHARGE OF A NUCLEAR POWER PLANT. J. Fish Biol., 5(4): 541-547.

A substantial winter-spring sport fishery has developed along the 1.83 km heated discharge canal of a nuclear power plant. An estimated 3166 fishermen caught an estimated 11,090 fish, representing 18 species, during a creel survey conducted from January through June, 1972. Eighty-seven percent of the canal fishermen were successful in catching one or more fish, and averaged 2.07 fish per rod-hour of effort. Fishermen averaged 1.08 fish per rod-hour and had a 61% success rate at other areas in the vicinity of the plant from April through November, 1965-1969. There was a correlation between the water temperature of the canal and the number of fish caught per rod-hour of effort. (Authors)

17008. Yoshiyasu, Katsuhiko, and Yosiyasu Humoto (Dept. of Otolaryngology, Fac. of Medicine, Osaka Univ., Osaka, Japan). 1972. STARCH-GEL ELECTROPHORESIS OF HEMOGLOBINS OF FRESHWATER SALMONID FISHES IN SOUTHWEST JAPAN - I. GENUS Salvelinus (CHAR). Bull. Jap. Soc. Sci. Fish., 38(7): 779-788. In English.

The hemoglobins (Hb's) of Salvelinus fishes (chars), including "iwana", "kirikuchi", "gogi", etc., which inhabit mainly the southwestern part of Japan, were analyzed by means of a vertical starch-gel electrophoresis. Results obtained were as follows: Their Hb patterns were almost indistinguishable from one another, and were similar to that of "amemasu" as reported by other authors. The previous proposal that Salvelinus fishes in Japan excepting "oshorokoma" can be classified as one species on the basis of the geographical continuous variation (cline) in the number of pyloric caecums or gill-rakers was strongly supported by the present data. (Authors.

17009. Ross, A. J., and W. T. Yasutake (Bur. of Sport Fish. and Wildl., Western Fish Disease Lab., Seattle, Washington 98115). 1973. Scolecobasidium humicola, A FUNGAL PATHOGEN OF FISH. J. Fish. Res. Bd. of Canada, 30(7): 994-995.

Scolecobasidium humicola, a previously undescribed fungal pathogen of fish was isolated from coho salmon (Oncorhynchus kisutch). In natural infections the kidney was the organ most affected. The disease was difficult to transmit experimentally and appeared to be only weakly contagious. (Authors)

17010. Khudoley, V. V. (Carcinogen Lab., The Prof. N. N. Petrov Oncological Res. Inst., USSR Ministry of Health, USSR). 1972. INDUCTION OF LIVER TUMORS BY SOME AZO COMPOUNDS IN AQUARIUM GUPPIES [Lebistes reticulatus (Peters)]. J. Ichthyol., 12(2): 319-324.

Carcinogens (orthoaminoazotoluene and dimethylaminoazobenzene) were added to the food of aquarium guppies [Lebistes reticulatus (Peters)]. It was established in chronic experiments that these compounds cause liver tumors - hepatocellular cancer, cholangioma and cholingiocarcinoma. Tumor frequency was 22.2%. The experimental data may be used for the indication of carcinogens in an aqueous medium.

17011. Raleigh, R. F., J. B. McLaren, and D. R. Graff (Dept. of Biol., the Pennsylvania State Univ., Univ. Park, Pennsylvania 16802). 1973. EFFECTS OF TOPICAL LOCATION, BRANDING TECHNIQUES AND CHANGES IN HUE ON RECOGNITION OF COLD BRANDS IN CENTRARCHID AND SALMONID FISH. Trans. Amer. Fish. Soc., 102(3): 637-641.

Cold branding with liquid nitrogen as a coolant appears to have an excellent potential for producing a durable recognizable mark on fish. The most frequent complaint voiced against cold branding has been a high variability in the quality and subsequent recognition of the mark. Four aspects of cold branding were tested and found to be effective in reducing variability in the quality of the brands. These are: use of branding tips with open simple designs and thin clean lines, application of the brand to selected locations on the fishes for a controlled period of time, and utilization of the ability of fishes to change hues during subsequent examinations for marks. (Authors)

17012. Tashiro, Fumio (Gifu Pref. Explt. Fish. Station, Hagiwara, Masuda-Gun, Gife Pref., Japan). 1972. EFFECTS OF IRRADIATION ^{60}Co GAMMA-RAY ON THE MATURATION OF RAINBOW TROUT. Bull. Jap. Soc. Sci. Fish., 38(8): 793-797. In Japanese with English abstract.

Eight groups of eyed eggs were subjected to gamma-ray doses of 100, 200, 400, 500, 600, 800, 1000 and 2000 rads, respectively. All the groups were incubated after irradiation and the fry were reared until they reached a mature stage. There appeared no differences in the rate of hatching among the eight groups. However, all the fry which had received above 800 rads of the gamma-irradiation died before reaching the advanced fry stage, whereas 50 to 80% of the fry which were subjected to less than 600 rads survived. A high percentage of deformed alevins was observed in the 2000 rads group. In the groups exposed to more than 400 rads of gamma-rays the percentage of fully mature fish decreased with the increase in gamma-ray dose. This phenomenon was observed more markedly in the females than in the males. In the groups which received less than 200 rads the percentage of mature fish was similar to that of the unexposed control group.

17013. Pitcher, T. J., and P. D. M. Macdonald (School of Biol. and Environ. Sciences, New Univ. of Ulster, Coleraine, Northern Ireland). 1973. A NUMERICAL INTEGRATION METHOD FOR FISH POPULATION FECUNDITY. J. Fish Biol., 5(4): 549-553.

The numbers of eggs laid by an age group of fishes is underestimated by a simple multiplication of fecundity at the mean length by the numbers of females when the conventional logarithmic relationship between fish length and egg numbers is employed. This paper sets out the conditions under which the error becomes significant and derives a method of calculating the correct integral. (Authors)

17014. Radford, D. S. (Fish & Wildl. Div., Dept. of Lands and Forests, Lethbridge, Alberta, Canada). 1973. A COMPARISON BETWEEN ACTUAL AND REPORTED ANGLING TIMES. Trans. Amer. Fish. Soc., 102(3): 641-643.

A t-test showed that actual and reported mean times spent angling by parties during each month of a creel survey on a lake in Alberta were not significantly different. A paired t-test showed no significant difference in means between the actual time and the reported time spent angling by parties which caught one or more fish and by parties which caught no fish. Any differences found are attributed to sampling. It is concluded that when one uses reported times in creel surveys, he must first determine if any significant difference exists between reported and actual mean times over an extended period of time before applying a correction factor to the reported catch ratio data. (Auth.)

17015. Bagenal, T. B., F. J. H. Mackereth (deceased), and J. Heron (The Freshwater Biol. Assn., Windermere Lab., Ambleside, England). 1973. THE DISTINCTION BETWEEN BROWN TROUT AND SEA TROUT BY THE STRONTIUM CONTENT OF THEIR SCALES. J. Fish Biol., 5(4): 555-557.

A method is described for distinguishing the scales of sea trout from brown trout by their strontium content. Scales of brown trout contain less than 200 μgSr/g and those of sea trout more than 300 μgSr/g. (Authors)

17016. Sosiak, A. J. (Dept. of Biol. Sci., Brock Univ., St. Catharines, Ontario, Canada). 1973. AN IMPROVED METHOD OF USING ONE-WAY GLASS TO ASSESS VISUAL DISCRIMINATION IN FISH. J. Fish. Res. Bd. Canada, 30(7): 1021-1022.

A method using one-way glass for presenting a test fish with a choice of two fish as visual stimuli was developed during a study to test visual discrimination by sunfish. This method is more effective than a previous one-way glass system in that it prevents habituation by test fish to their reflections in the one-way glass and makes nonvisual recognition cues less likely. (Auth.)

17017. Strebkova, T. P. (All-Union Res. Inst. for Sea Fish. and Oceanography (VNIRO), Moscow, USSR). 1972. THE EFFECT OF ANESTHETICS (THIOPENTAL SODIUM) ON THE PHYSIOLOGICAL CHARACTERISTICS OF MIRROR CARP [Cyprinus carpio (L.)] UNDERYEARLINGS. J. Ichthyol., 12(2): 361-365.

There is an increase in the survival of carp underyearlings anesthetized with thiopental sodium and kept without water (in a humid environment). The respiratory rate in experimental fish is reduced following anesthesia with thiopental sodium. The numerical expression of the blood indices is altered under the influence of environmental conditions; thiopental sodium in a concentration of 0.05 g/liter was not found to have a toxic effect on carp underyearlings. (Auth. conclusions)

17018. Simidu, Usio, and Syuzo Egusa (The Inst. of Food Microbiol., Chiba Univ., Izumi-cho, Narashino-shi, Chiba Pref., Japan). 1972. A RE-EXAMINATION OF THE FISH-PATHOGENIC BACTERIUM THAT HAD BEEN REPORTED AS A Pasteurella SPECIES. Bull. Jap. Soc. Sci. Fish., 38(8): 803-812. In English.

Morphological and biochemical characteristics were examined on four strains of the bacteria causative of "pseudotuberculosis" among yellowtail (Seriola quinqueradiata), and on a strain of Pasteurella piscicida, Janssen et Surgalla. The observation that the pseudotuberculosis organisms were identical with P. piscicida was confirmed. These organisms were all Gram-intermediate, non-motile rods. A peculiar morphological feature of the organisms is the transformation from rod-shaped cells in the early logarithmic growth phase to small coccoids or cocci in the stationary phase. The organisms gave positive Kovacs' oxidase reaction; fermented glucose in Hugh-Leifson's medium, and produced acid but no gas from a few other carbohydrates such as fructose, galactose, and mannose. They were sensitive to most of the antibiotics and antimicrobial drugs, including penicillin and polymyxin B; were halophilic; and did not grow at pH lower than 6.1. Although the cells of these organisms did not show any typical coryneform appearance, nevertheless, the above characters suggest that they have a close relationship with coryneform bacteria and genus Arthrobacter seemed to be the most suitable genus to which they belong.

17019. Tucker, D. (Dept. of Biol. Sci., Florida State Univ., Tallahassee, Florida 32306). 1973. RAPID DECLINE OF OLFACTORY AND GUSTATORY RECEPTOR SENSITIVITIES OF WILD CATFISH (ICTALURIDAE) AFTER CAPTURE. J. Fish. Res. Bd. Canada, 30(8): 1243-1245.

In several species of catfish (Ictaluridae), comparably high sensitivities of olfactory and gustatory receptors to α-amino acids as a class were confirmed. An important determinant of the frequency of successful electrical recording preparations was found to be the duration of fish captivity. The functional deterioration of olfactory and gustatory receptors may be a stress reaction caused by capture and confinement of the wild fish. (Auth.)

17020. Girsa, I. I. (A. N. Severtsov Inst. of Evol. Morphol. and Animal Ecol. (IEMEZh), Moscow, USSR). 1972. THE EFFECT OF PHOTOPERIOD AND WATER TEMPERATURE ON PHOTOREACTION IN SOME FISH. J. Ichthyol., 12(3): 505-510.

The photoreaction of the "verkhovka" (Leucaspius delineatus) was modified by altering the photoperiod, the relative duration of the dark and light periods of the day. After having been kept in the winter daily at 17 hours of illumination and 7 hours of darkness and a temperature of 18°C for a month, the "verkhovka" manifested an indifferent reaction to light and did not avoid light; fish kept at 17 hours of darkness and 7 hours of light (the other conditions were the same) manifested a negative reaction to light. At a temperature of 11°C and any proportions of light and darkness the reaction of the "verkhovka" was strictly photonegative. The level of the photoreaction of the "verkhovka" is higher in the summer than in the winter. Reduced temperature did not affect the reaction of juvenile roach and bleak to light. The positive photoreaction of juvenile burbot was increased at temperature conditions unusual for them (7 and 27°C). As the burbot grew older the positive reaction to light was replaced by a negative reaction. This change coincided approximately with the period when the young leave the upper layers of water and change the nature of their feeding.

17021. Herke, William H. (La. Coop. Fishery Unit, La. State Univ., Baton Rouge, Louisiana 70803). 1973. SPIN-DRYING OF PRESERVED FISHES AND MACROINVERTEBRATES. Trans. Amer. Fish. Soc., 102(3): 643-645.

Precise weights of specimens preserved in liquids can be obtained rapidly if one uses the spin cycle of a washing machine to remove excess liquid. Although weights obtained by this method are reproducible, many factors can affect length-weight comparisons. Readers are cautioned of the difficulties in making comparisons between separate studies. (Auth.)

17022. Tsuyuki, H., and S. N. Williscroft (Fish. Res. Bd. of Canada, Vancouver Lab., Vancouver 8, British Columbia, Canada). 1973. THE pH ACTIVITY RELATIONS OF TWO LDH HOMOTETRAMERS FROM TROUT LIVER AND THEIR PHYSIOLOGICAL SIGNIFICANCE. J. Fish. Res. Bd. Canada, 30(7): 1023-1026.

The LDH homotetramers from the liver tissues of B'B'' and B'B' steelhead trout phenotypes were each demonstrated to possess two pH optima, the usually described broad one spreading over 1.0 units in the alkaline region, and a new extremely narrow one spread over 0.128 units in the physiological range. The narrow pH optimum of LDH-B''$_4$ in the lactate to pyruvate reaction exhibited an optimum at 7.302 and that of LDH-B'$_4$ at 7.430. In the opposite reaction, LDH-B''$_4$ and -B'$_4$ passed through equally sharp minima at pH 7.331 and 7.428, respectively. At their respective narrow pH optima, LDH-B''$_4$ exhibited a lactate conversion rate 3.6 times higher than that of LDH-B'$_4$. The possible physiological significance of the narrow pH optima to poikilotherms and the differential lactate conversion rate to relative swimming endurance between the two phenotypes are discussed. (Authors)

17023. White, George E. (Texas Parks & Wildl. Dept., Jasper State Fish Hatchery, Jasper, Texas 75951). 1973. SOME REPRODUCTIVE CAPABILITIES OF THE TEXAS GOLDEN GREEN SUNFISH. Prog. Fish-Cult., 35(2): p. 96.

17024. Kusuda, Riichi, and Masaoki Yamaoka (Dept. of Cultural Fisheries, Fac. of Agric., Kochi Univ., Nangoku, Kochi Pref., Japan). 1972. ETIOLOGICAL STUDIES ON BACTERIAL PSEUDOTUBERCULOSIS IN CULTURED YELLOWTAIL WITH Pasteurella piscicida AS THE CAUSATIVE AGENT - I. ON THE MORPHOLOGICAL AND BIOCHEMICAL PROPERTIES. Bull. Jap. Soc. Sci. Fish., 38(12): 1325-1332. In Japanese with English abstract.

Since 1969, bacterial pseudotuberculosis has been associated with serious mortality of cultured young yellowtails during the summer months in many yellowtail farms on the west coast of Japan. The disease is characterized by the deposition of greyish white bacterial colonies, each covering an area of approximately 0.5-1.0 mm at innumerable sites in the spleen and the kidney. The cultures isolated from spleen and kidney lesions were small Gram-negative rods. In some instances, cultures from spleens and kidneys yielded an almost pure growth of this organism on nutrient agar and on blood agar. The organism grew in tiny, non-haemolytic, dew-drop-like colonies on nutrient agar at 25°C in 48 hours; there was no growth at 35°C. The colonies had a margarine-like consistency. The organism was non-motile displaying a fairly uniform morphology. Acid was produced in glucose, fructose, galactose and mannose; but on gas production was evident; there was no observable reaction in xylose, arabinose, rhamnose, saccharose, maltose, trehalose, mannitol, lactose, sorbitol, salicin and dulcitol. The organism did not utilize citrate and failed to grow in a potassium cyanide medium. It was catalase and oxidase positive. The organism was therefore identified as Pasteurella piscicida Janssen and Surgalla (1968).

17025. Emadi, Hossein (Dept. of Fish. & Wildl., Oregon State Univ., Corvallis, Oregon 97331). 1973. YOLK-SAC MALFORMATION IN PACIFIC SALMON IN RELATION TO SUBSTRATE, TEMPERATURE, AND WATER VELOCITY. J. Fish. Res. Bd. Canada, 30(8): 1249-1250.

Chum (Oncorhynchus keta), pink (O. gorbuscha), sockeye (O. nerka), and hybrid (pink X chinook) salmon alevins were susceptible to yolk-sac malformation when provided a smooth substrate as in standard hatchery incubators, at 12C and a water velocity of 100 cm/hr. Chinook (O. tshawytscha) and coho (O. kisutch) alevins were not susceptible. In sockeye, malformations increased with increase in temperature from 8 to 12 and 14C and, at 14 but not at 12C, with increase in water velocity from 25 to 400 cm/hr. Replacement of the smooth substrate with a rough (gravel) substrate usually prevented the condition. (Auth.)

17026. Bogdanova, L. S. (Leningrad Univ., Leningrad, USSR). 1972. THE TRANSITION TO EXOGENOUS FEEDING IN THE LARVAE OF Coregonus lavaretus ludoga Poljakov (THE LAKE LADOGA "LUDOGA" WHITEFISH). J. Ichthyol., 12(3): 531-537.

Data are given in the article on the morphology of ludoga larvae; particular attention is given to fin development. An examination is made of the state of the digestive system (histologic analysis). It is concluded that the transition from yolk feeding to exogenous feeding is not a "critical" stage. External morphology and the condition of the larval digestive system are such that the larvae can transfer to exogenous feeding without losses if appropriate food is available.

17027. Rode, Randall (Aquatic Sciences, Inc., 2624 N.W. 2nd Ave., Boca Raton, Florida 33432). 1973. AN AUTOMATED DEVICE FOR FEEDING AQUATIC ORGANISMS. Trans. Amer. Fish. Soc., 102(3): 645-646.

An automatic, 36 liter system with a 4-hour timer was found to effectively deliver cultured foods to larval rearing systems. (Auth.)

17028. Johnson, Sterling K. (Dept. of Fish. and Allied Aquacultures, Auburn Univ. Agric. Exp. Sta., Auburn, Alabama 36830). 1971. NORTH AMERICAN DISTRIBUTION RECORD FOR Paraergasilus Markewitsch, 1937 (COPEPODA: CYCLOPOIDEA: ERGASILIDAE). J. Parasitology, 57(5): p. 1051.

17029. McCauley, R. W., and L. A. A. Read (Waterloo Lutheran Univ., Waterloo, Ontario, Canada). 1973. TEMPERATURE SELECTION BY JUVENILE AND ADULT YELLOW PERCH (Perca flavescens) ACCLIMATED TO 24 C. J. Fish. Res. Bd. Canada, 30(8): 1253-1255.

Samples of juvenile and adult yellow perch (Perca flavescens) were obtained from the same habitat and at the same time from two separate water sources to study the differences, if any, in their preferred temperatures. The fish, acclimated to 24 C, were subjected to a vertical temperature gradient. Juveniles selected temperatures in the range 20.0-23.3 C and adults in the range 17.6-20.1 C. It is concluded that age plays an important role in temperature selection in this species. (Authors)

17030. Nomura, Shin-ichi, Teisuke Ibaraki, Hisashi Hirose, and Soichiro Shirahata (Fac. of Agric., Univ. of Tokyo, Tokyo, Japan). 1972. APPLICATIONS OF BACK-PACK CARDIOTELEMETER FOR FISHES - I. HEART RATE AND CARDIAC REFLEX IN FISHES DURING UNRESTRAINED SWIMMING. Bull. Jap. Soc. Sci. Fish., 38(10): 1105-1117. In Japanese with English abstract.

The rainbow trout, Salmo irideus, and sockeye salmon, Oncorhynchus nerka, on which a radiotransmitter was mounted, were allowed to swim in a stream and the ECG information was conveyed over wireless transmission. The velocity of the current was controlled by means of opening and closing a sluice at the lower reach of the stream. The heart rate, the beats per minute rate, during free swimming remained unchanged and maintained a nearly settled frequency, independent of the acceleration and deceleration of water current in which the fish was free to transverse. Lutz's experiment on cardiac reflex was re-examined by increasing and decreasing the water supply to the gills of carp, Cyprinus carpio. An increase in the rate of water to the gills caused an increase in the heart rate insofar as the fish was placed in a state of asphixia, being exposed to the air. The nature of this result did not exactly fit the case when the fish was placed in an aquarium and its gills bathed by the water. The rate of heart beat during free rapid swimming was considered to be determined by the particular speeds necessary to be sustained during periods of swimming, a cruising speed, in ambient water temperature, and by the rate of water flow through the mouth on inspiration.

17031. Edmunds, Philip H., and James I. Sammons, III (NMFS, Northeast Fish. Center, Narragansett Lab., Narragansett, R. I. 02882). 1973. SIMILARITY OF GENIC POLYMORPHISM OF TETRAZOLIUM OXIDASE IN BLUEFIN TUNA (Thunnus thynnus) FROM THE ATLANTIC COAST OF FRANCE AND THE WESTERN NORTH ATLANTIC. J. Fish. Res. Bd. Canada, 30(7): 1031-1032.

Using electrophoretic techniques, we found three phenotypes of the enzyme tetrazolium oxidase in bluefin tuna (Thunnus thynnus) from the Bay of Biscay. The phenotypes were indistinguishable from those that in western Atlantic bluefin are controlled by two codominant, autosomal alleles. The frequency distributions of phenotypes in eastern and western Atlantic samples do not differ significantly from each other, nor does a frequency distribution of phenotypes in the combined sample differ significantly from a Hardy-Weinberg distribution. These facts support the hypothesis that bluefin tuna from the Bay of Biscay and from the western North Atlantic might belong to a single breeding population rather than to geographically discrete races. The facts are consistent with evidence from tagging, which shows sporadic transoceanic migration. (Authors)

17032. Dronen, N. O., Jr. (Dept. of Biol., New Mexico State Univ., Univ. Park, Las Cruces, New Mexico 88003). 1973. STUDIES ON THE MACROCERCOUS CERCARIAE OF THE DOUGLAS LAKE, MICHIGAN AREA. Trans. Amer. Micros. Soc., 92(4): 641-648.

Three macrocercous cercariae are described in detail and their second intermediate hosts determined. The cercariae appear to belong to the family Echinostomatidae and are compared to a macrocercous cercaria of the genus Petasiger. Some notes on preliminary experiments to determine the identity of the adult parasites are also included. (Auth.)

17033. Power, G., and Lloyd H. Saunders (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1973. AN ERROR IN LOGIC IN ESTIMATING STREAM POPULATIONS OF PREMIGRANT TROUT FROM STREAM SURVIVAL RATES AND LAKE POPULATIONS. J. Fish. Res. Bd. Canada, 30(7): 1033-1034.

17034. Burton, Dennis T., and Philip R. Abell (Acad. of Natural Sciences of Philadelphia, Benedict Estuarine Lab., Benedict, Maryland 20612). 1973. VENTILATION RATE CHANGES IN THE FLATFISH, Trinectes maculatus, SUBJECTED TO RAPID THERMAL INCREASES AND ENVIRONMENTAL HYPOXIA. Assoc. Southeastern Biologist Bull., 20(2): p. 43.

This study was initiated to gain base line information on ventilation responses of the estuarine fish, Trinectes maculatus, exposed to two possible environmental stresses which may result from power plant operations. The effects of rapidly increasing water temperatures were studied using fish acclimated to 5, 15 and 25°C. Water temperatures were rapidly increased 5°C above ambient and maintained at the elevated temperature for 24 hours. Ventilation rates increased concurrently as temperatures increased. Ventilation quickly stabilized at the higher rates and remained relatively constant throughout the 24 hours in all acclimation groups. The effects of environmental hypoxia and the combined effects of increasing temperatures plus hypoxia were investigated in 25°C acclimated fish. Gradual hypoxia caused an increase in ventilation rate followed by a rapid decrease at very low oxygen concentrations. Responses during gradual development of normoxia were characterized by a rapid increase above pre-stress rates followed by a decrease to pre-stress rates once air saturation oxygen concentrations were reached. Similar ventilation responses were found when dissolved oxygen concentrations were rapidly reduced and water temperatures simultaneously increased from 25°C to 30°C. These results suggest that low dissolved oxygen concentrations may cause greater physiological adjustments than rapid temperature increases. (Authors)

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